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UME 62

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PHYSICS ABSTRACTS

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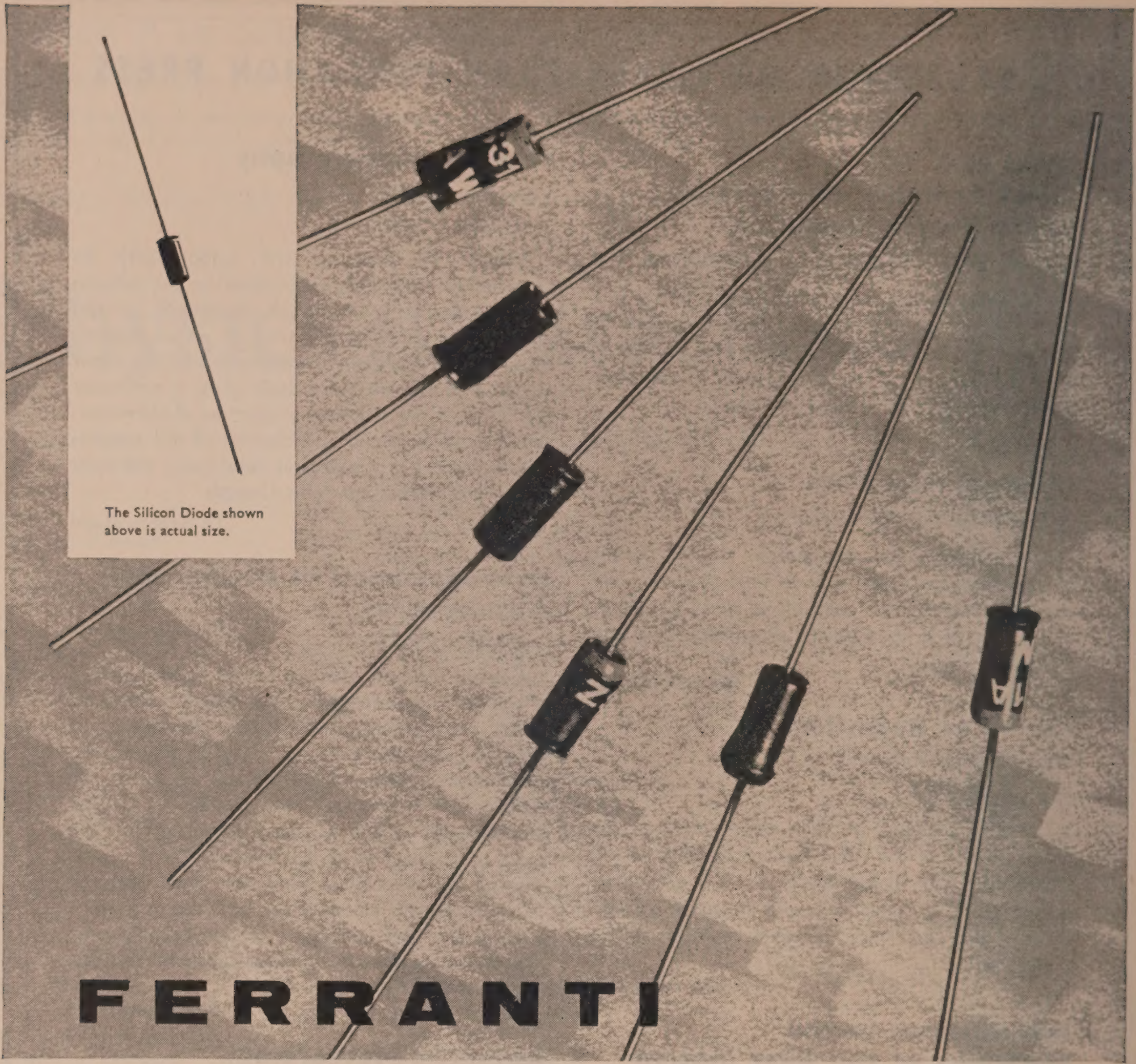

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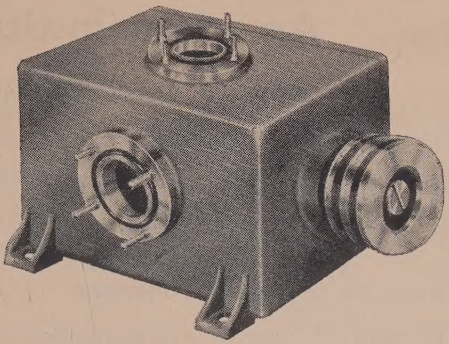

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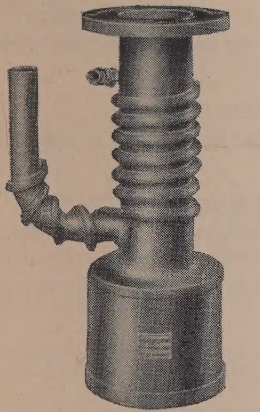

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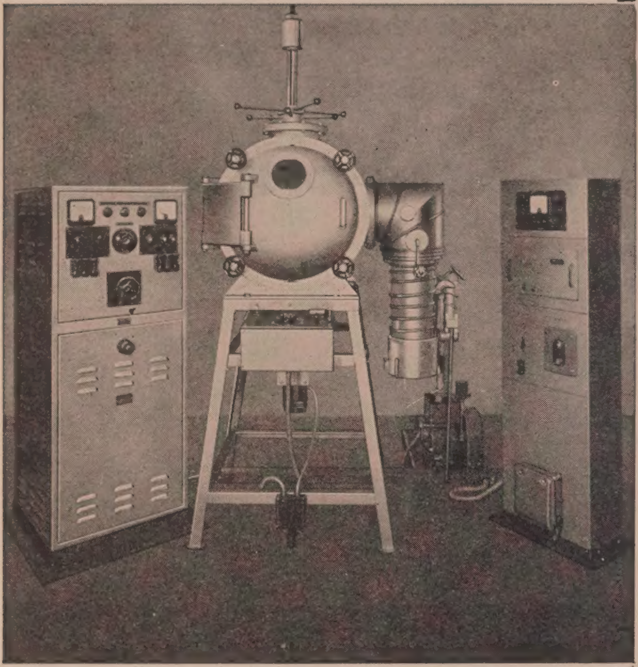

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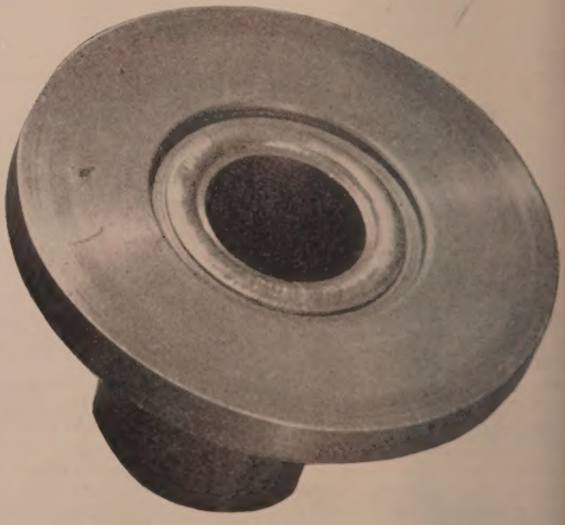

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PHYSICS ABSTRACTS

lume 62 SEPTEMBER 1959 Number 741

MATHEMATICS

517.5

27. CONNECTIONS BETWEEN GENERALIZED SINGULAR NCTIONS AND BESSEL FUNCTIONS. E.Montaldi.
ovo Cimento, Vol. 12, No. 6, 571-92 (June 16, 1959).

After introducing a suitable extension of the concept of the eneralized singular function", a somewhat detailed mathematical estigation of the structure of the integrals involved is made. ong the main results, various integral relationships are obtained, ich show the intimate connection between generalized singular ctions and Bessel functions.

517.6 : 535.42

RELATION BETWEEN THE INVERSION FORMULAS FOR THE MMERFELD INTEGRAL AND THE FORMULAS OF KONTORO-CH--LEBEDEV. See Abstr. 8000

517.9 : 536.2

28. ON THE SEPARABILITY CONDITIONS OF SOLUTIONS OF NEAR PARABOLIC EQUATIONS IN ORTHOGONAL COORDINATES. N.Rȳkalin.
kl. Akad. Nauk SSSR, Vol. 125, No. 3, 519-22 (March 21, 1959). Russian.

The equations are considered in an n-dimensional space and solutions are subjected to general Cauchy boundary conditions. utions are found to be separable if: (a) the sub-space, where they defined, is an intersection of hyper-cylindrical sub-spaces; no terms of the differential operator contain two or more co-dinate variables; (c) only momentary sources are present. An ample is given concerning temperature distribution in a cylinder.
J.K.Skwirzynski

518.4

29. CONVENIENT PLOT FOR EXPONENTIAL FUNCTIONS TH UNKNOWN ASYMPTOTES. P.C.Mangelsdorf, Jr.
appl. Phys., Vol. 30, No. 3, 442-3 (March, 1959).

Given a simple transient function of time

$$y = A\,e^{-\alpha t} + B,$$

ere A, α and B are unknown, these latter can be found directly by tting y(t) against y(t + Δt) on a linear graph. J.K.Skwirzynski

518.5 : 681.142 : 621.317.79

9130. ROTATING-DISK FUNCTION GENERATOR FOR ANALOG COMPUTERS. M.E.Young, W.M.Alexander and H.D.Schwetman.
Rev. sci. Instrum., Vol. 30, No. 5, 318-22 (May, 1959).

A simple device for the production of varying potentials which represent four functions of the form $f(t) = at$, $f(t) = at + b \sin \omega t$, $f(t) = at^2 + b$, and $f(t) = a$ for (50 msec $\leq t \leq$ 100 msec) and a rate of operation of 5 c/s is described. It makes use of a rotating disk of variable radius to control the light incident upon the cathode of a photomultiplier tube. The accuracy of the functions is about 4%, with the exception that near points of discontinuity, maximum errors of 4 to 10% were observed. The method of preparing the disk, use of the functions in the solution of linear, ordinary differential equations, and an analysis of the error are presented.

518.5 : 537.54 : 681.142 : 621.317.79

9131. MECHANICAL ANALOG COMPUTER FOR SOLVING THE AXIAL EQUATIONS OF MOTION DURING BUNCHING IN LINEAR ELECTRON ACCELERATORS. P.T.Demos.
Rev. sci. Instrum., Vol. 30, No. 7, 543-7 (July, 1959).

A mechanical analogue computer is described which is suitable for the exploratory study of linear accelerator designs in the bunching region, at least in problems of the kind encountered in electron accelerators, where bunching is accomplished in comparatively short intervals and with relatively few phase oscillations. Particle phase is observed directly from a resolver; and particle momentum, particle velocity, and accelerating wave phase velocity are observed simultaneously as linear magnitudes whose relative change during calculation provides useful intuitive guidance in the choice of accelerator parameters. Some calculations are reported which were made with a rough apparatus capable of ~ 5% accuracy.

519.271

9132. A NOTE ON NUMERICAL EVALUATION OF THE INTEGRAL SQUARE ERROR. S.Minagawa.
J. Phys. Soc. Japan, Vol. 13, No. 9, 1069-70 (Sept., 1958).

A new method of calculating the integral square error numerically, from a system response curve, is proposed, giving more speed and better accuracy than direct integration of the square of the error. T.O.Jeffries

ASTROPHYSICS

523.112

33. TOWARDS THE FORMULATION OF THE DISPENSABILITY AN EXPANDING UNIVERSE ON THE BASIS OF THE GENERAL IEORY OF RELATIVITY. A.L.Zel'manov.
kl. Akad. Nauk SSSR, Vol. 124, No. 5, 1030-3 (1959). In Russian.

In the general theory of relativity, the transition from a homoneous, isotropic cosmological model to an anisotropic heteroneous universe leads to the necessity of establishing an answer the question whether an expanding universe is theoretically dis-nsable or not. Such an answer, however, will depend on the way question is asked. Thus the author suggests it essential that invariants of the space—time continuum should be considered ther than its extension in time. Several proposed metrics are en studied and it is claimed that these show in all cases that an inite universe (in time and space) cannot but be a part of another stem. J.K.Skwirzynski

523.16

9134. HIGHLY IONIZED REGIONS OF INTERSTELLAR MATTER. A.M.Rozis-Saulgeot.
C.R. Acad. Sci. (Paris), Vol. 248, No. 5, 650-3 (Feb. 2, 1959).
In French.

A remarkable correspondence is shown between properties of such HII regions and those (especially superconductivity) of metals at very low temperatures. Includes a new explanation for the light curves of the brilliant margins of HII regions. G.A.Chisnall

523.164

9135. ATTEMPTED DETERMINATION OF THE VERY SMALL APPARENT DIAMETERS IN RADIOASTRONOMY. J.Arsac.
Optica Acta, Vol. 6, No. 1, 77-98 (Jan., 1959). In French.

Use has been made of a theory of distributions to show how interferometer records can be used to set limits to the apparent diameter of a radio star without making assumptions about the shape of the object. H.J.A.Chivers

523.164.32 : 523.745

9136. RELATION BETWEEN TYPE IV EMISSIONS AND OTHER FORMS OF SOLAR ACTIVITY. Y.Avignon and M.Pick.
C.R. Acad. Sci. (Paris), Vol. 248, No. 3, 368-71 (Jan. 19, 1959).
In French.

A close correlation is found between the positions of optical features associated with type IV radio bursts, and the centres of solar radio storm regions. H.J.A.Chivers

523.164.32 : 550.385

RELATIONS BETWEEN SOLAR RADIO ACTIVITY AND SUDDEN COMMENCEMENT MAGNETIC STORMS. See Abstr. 9058

523.164.32

9137. TIME RELATIONSHIP OF METRE-WAVE AND 3 cm WAVE BURSTS. M.R.Kundu.
Nature (London), Vol. 183, 1047-8 (April 11, 1959).

A comparison of the times of occurrence of solar bursts observed at 3 cm and one metre wavelengths, shows that although they occur almost simultaneously on the two frequencies if the diameter of the active region is less than 1.5 min of arc, there is an appreciable delay in the metre-wave bursts relative to the 3 cm bursts for regions of greater diameter. The small diameter regions appear to be associated with the ejection of ionized material at velocities in excess of 1000 km/s while the regions of larger diameter correspond to velocities of the order of 500 km/s. C.Hazard

523.164.34

9138. RADIO INTERFERENCE CAUSED BY THE MOON'S IONOSPHERE. G.A.Gurzadyan.
Dokl. Akad. Nauk SSSR, Vol. 118, No. 5, 884-7 (1958). In Russian.
English tranlation in Soviet Physics — "Doklady" (New York),
Vol. 3, No. 1, 1-4 (Jan.-Feb., 1958).

A fluctuating increase of about 10% is sometimes observed in the radio emission from the sun before the beginning and at the end of eclipses. This is explained in terms of the interference between direct radio waves from small diameter sources on the sun and the waves from these sources refracted by the moon's atmosphere. The fluctuations will increase with wavelength. R.D.Davies

523.164.34

9139. A "LUNAR" RADIO INTERFEROMETER. G.A.Gurzadyan.
Dokl. Akad. Nauk SSSR, Vol. 118, No. 6, 1094-8 (Feb. 21, 1958).
In Russian. English translation in : Soviet Physics — "Doklady"
(New York), Vol. 3, No. 1, 15-18 (Jan.-Feb., 1958).

In this note the moon is assumed to have an ionosphere. Radio waves from a radio source close to the moon may reach a point on the earth directly or by refraction through the lunar ionosphere. The resultant interference pattern is investigated and it is shown that if this pattern can be observed for radio sources being eclipsed by the moon it will permit the measurement of diameters of radio sources of the order of tenths of minutes of arc. Observation of the interference pattern would also give information on the state of the lunar ionosphere. C.Hazard

523.164.34

9140. RADIO OBSERVATIONS OF THE LUNAR SURFACE.
J.K.Hargreaves.
Proc. Phys. Soc., Vol. 73, Pt 3, 536-7 (March, 1959).

It is shown that the angle at which radio waves are scattered from the lunar surface is determined by (a) the average gradient over areas of several Fresnel zones and (b) by diffraction within these areas. Radar observations at shorter wavelengths, and thus using smaller sampling areas, should give statistical information about features of the lunar surface. R.D.Davies

523.164.42

9141. ON THE INTENSITY DISTRIBUTION OF THE DISCRETE RADIO SOURCE, TAURUS-A. V.A.Udal'tsov and V.V.Vitkevich.
Astron. Zh., Vol. 35, No. 5, 713-21 (1958). In Russian.

523.165 : 537.591.1

9142. ON THE COMPOSITION OF COSMIC RADIATION IN SOURCES OF PRIMARY ACCELERATION. A.A.Korchak.
C.R. Acad. Bulg. Sci., Vol. 10, No. 4, 261-4 (July-Aug., 1957).
In Russian.

Statistical and inductive acceleration mechanisms are considered for cosmic ray energies ranging from thermal, to those applicable to to the outer layers of stars, novae or super-novae. A formula is obtained for the constitution of the primaries so accelerated, subject to a certain limitation on the acceleration parameter L. It is shown that for very intensive primary accelerations the concept of a single "injection energy" breaks down. J.W.Gardner

523.165 : 537.591.1

9143. ON THE COMPOSITION OF PRIMARY COSMIC RADIATION.
A.A.Korchak.
C.R. Acad. Bulg. Sci., Vol. 10, No. 4, 265-8 (July-Aug., 1957).
In Russian.

Reports studies of change in constitution of galactic cosmic radiation due to diffusion and accelerations after leaving the primary energy source. Assuming a constant mean life for all particles, a relation is obtained between constitution and the maximum energy the "primary accelerator" is capable of communicating to particles of a given mass and charge. For both Fermi-type and inductive accelerations this relation is such that, to yield the observed constitution, the primary accelerating mechanism must furnish an excess of heavy nuclei. J.W.Gardner

523.32

9144. SUB-SURFACE TEMPERATURES ON THE MOON.
J.C.Jaeger; J.H.Fremlin.
Nature (London), Vol. 183, 1316-17, 1317-18 (May 9, 1959).

Jaeger shows that the very high lunar temperatures (~ 1200° C) postulated by Fremlin (Nature, Vol. 183, 239, Jan. 24, 1959) result from the use of too low a value for the thermal conductivity of the dust stratum, and too high a value for the lunar heat flux due to radioactivity. Fremlin replies that his suggested model fits the recent observations of hot lunar gases by Kozyrev (1958) which, according to Jaeger's conclusions, could not have occurred. He is unwilling to abandon his hypothesis in the absence of a satisfactory alternative explanation of Kozyrev's observations. D.R.Barber

523.5

9145. THE MEAN CHARACTERISTIC HEIGHT OF METEORS DETECTED BY RADIO OBSERVATIONS. E.I.Fialko.
Astron. Zh., Vol. 35, No. 6, 881-7 (1958). In Russian.

The distribution of characteristic heights of meteors is considered. The mean characteristic height of meteors with a given velocity is found. The mean characteristic height of the detected meteors depends slightly on the parameters of the radar apparatus. Ways of increasing the range of meteor radar observations are considered.

523.59

9146. ON THE REDUCTION OF OBSERVATIONS OF ZODIACAL LIGHT. V.G.Fesenkov.
Astron. Zh., Vol. 35, No. 3, 323-6 (1958). In Russian. English translation in: Soviet Astron. — AJ (New York), Vol. 2, No. 3, 299-302 (May-June, 1958).

Blackwell (1957) has shown that there is no definite relation between point source extinction according to Bouguer and the extinction corresponding to such an extended object as zodiacal light. In fact, the optical density of the atmosphere remains always the same, independently of the nature of the light source, although it is necessary to take into account the additional illumination of the troposphere produced by the zodiacal light itself. Calculations carried out in the case of normal orientation of the isophots relative to the horizon show that this effect produces an appreciable distortion of the apparent shape of zodiacal light. Assuming that the coefficient of transparency is equal to 0.83, and the scattering function corresponds to that found by Piaskovskaia—Fesenkova (1957), one found for different points of the same almucantar, at the zenith distance of 75°, and for various azimuths, the following relative increase in brightness:

A 0	10	20	30	40°
5.84%	7.83%	11.62%	15.95%	30.6%

523.59

9147. ZODIACAL LIGHT AS THE PRODUCT OF DISINTEGRATION OF ASTEROIDS. V.G.Fesenkov.
Astron. Zh., Vol. 35, No. 3, 327-34 (1958). In Russian. English translation in: Soviet Astron. — AJ (New York), Vol. 2, No. 3, 303-9 (May-June, 1958).

The disintegration of asteroids is at present being investigated experimentally, since for a number of meteorites it is possible to find the approximate date of their separation from a primary body and their transformation into individual bodies revolving around the sun and subject to the influence of primary cosmic rays. This process of disintegration leads to the appearance of a considerable amount of fine dust which spreads into space. The density of this

ıst, at a distance comparable with the earth—sun distance, which
necessary to explain the observed brightness of zodiacal light is
ıly 10^{-23}-10^{-24} g/cm^3 (lower limit). The problem of the polariza-
on of zodiacal light is more complicated. Atmospheric data lead
the conclusion that dry aerosols which contain a known fraction of
eteoritic particles give an appreciable polarization. The strongest
gument in favour of the meteoritic nature of zodiacal light, which
esults from the disintegration asteroids, is the good agreement be-
een its observed form and the theoretical isophots calculated from
e known distribution of asteroid orbits with inclination angles.
ıe set of isophots given was calculated assuming a typical scatter-
g function obtained by Piaskovskaia—Fesenkova (1957), while the
her set was obtained assuming a spherical scattering function.
ıe former is in better agreement with observations.

523.663

**148. THE MOTION OF TAIL MATERIAL OF THE COMET
rkos (1957d). R.Lüst.**
. Astrophys., Vol. 47, No. 3, 205-7 (1959). In German.

523.663

**149. THE MOTION OF MATERIAL IN THE TAIL OF THE
OMET MOREHOUSE, 29 OCTOBER 1908. P.Stumpff.**
. Astrophys., Vol. 47, No. 4, 225-65 (1959). In German.
The motions of the streamers and of condensations were ob-
ined from two photographs taken by Wolf. From measurements,
e kinematics and the dynamics of the tail particles are investigated,
king into account possible spatial structures of the tail. The
ccelerations (referred to the gravitational acceleration of the sun)
ere of the order of 10 for the central part of the tail and increase
about 10^3-10^4 in the outer parts. Both the fact that the accelera-
on increases away from the axis, and the order of magnitude
ached in the outer part of the tail, are compatible with the mech-
ism proposed by Biermann (Abstr. 3216 of 1952), which takes into
ccount the interaction between the solar corpuscular radiation and
e ionized gases in the tail. An alternative interpretation of the
easurements based on the assumption of a low and constant value
r the acceleration leads to improbable conditions for the emission
material from the nucleus. It is shown that even if extreme
ssumptions are made concerning the spatial structure of the tail the
oove conclusions remain essentially unaltered.

523.745

**150. AREA AND POSITION OF CALCIUM FLOCCULI OBSERVED
T THE SOLAR TOWER OF THE ARCETRI OBSERVATORY IN
957. G.Godoli.**
em. Soc. Astron. Ital., Vol. 29, No. 4, 521-35 (1958). In Italian.
The projected and corrected areas are given for single
oservations and also monthly, half yearly and yearly averages.
he average number per day are given together with the yearly mean
eliographic latitude. J.M.Hough

523.745

**151. DETERMINATION OF THE PHOTOMETRIC SCALE OF
AGNITUDE FOR THE Hα FLARES OBSERVED AT THE SOLAR
OWER OF ARCETRI IN 1953-56. M.C.Ballario.**
em. Soc. Astron. Ital., Vol. 29, No. 4, 439-64 (1958). In Italian.
369 bright flocculi were measured photometrically by com-
arison with the intensity of an adjacent quiet zone. The relative
tensity (r) was compared with visual estimates of importance.
he results found were:

Magnitude 1 : r = 2.24 to 3.02

2 : r = 3.09 to 3.98

3 : r greater than 4.07

central bright flocculus is classified as a flare if its intensity is
eater than 0.43 of the intensity of the continuum at the sun's
ntre. Variation of brightness curves with time are given for some
occuli. J.M.Hough

523.746

**52. AN ATTEMPT TO DETERMINE THE PRESSURE IN SUN-
OTS. G.Laborde.**
R. Acad. Sci. (Paris), Vol. 248, No. 13, 1941-3 (April 1, 1959).
French.
Based on the measurement of the ratio of equivalent widths of
lines in sunspot spectra, and in the spectrum of the photosphere,
lationships connecting temperature and pressure are derived for
ese two zones. The pressure in the spot zone appears relatively insensitive to spot temperature, but it is very dependent on photospheric temperature. For optical depth, $\tau = 0.04$, where the C_2 lines originate, the results indicate a similar order of magnitude for both sunspot and photospheric pressures. D.R.Barber

523.75 : 523.165

9153. ON THE PRODUCTION OF HIGH-ENERGY PARTICLES AND HARD RADIATION IN SOLAR FLARES. A.B.Severnyi.

Dokl. Akad. Nauk. SSSR, Vol. 121, No. 5, 819-22 (1958). In Russian. English translation in: Soviet Physics — "Doklady" (New York), Vol. 3, No. 4, 698-700 (July-Aug., 1958).

Cinematography of typical flare emissions provides valuable evidence of the transient character of these explosive outbursts. Main results from this study are as follows. (1) Bright wave-fronts moving at supersonic velocities sometimes occur, and indicate shock-wave development. When the waves approach a sunspot region they brighten, and commence to spread with diminished velocity along the lines of force of the sunspot magnetic field. (2) The non-stationary continuous emission originates in optically thin grains at various depths in the sun's atmosphere. The spectral distribution of this radiation, and its low polarization, both point to a non-thermal origin. (3) The observed strengthening of the $D\alpha$-line in flares (and in non-flare wide-line emission) shows that neutrons may be produced in these disturbed regions. (4) Both cosmic-ray particles (of energy 10^9-10^{11} eV) and X-radiation (but not $L\alpha$-radiation as previously thought) are produced in flare outbursts. (5) Flares originate at the neutral points of the solar magnetic field, and lead to a breakdown of the field near the neutral point. (6) The discharge hypothesis is inadequate to explain the origin of flares since the current density is insufficient to provide for the required energy liberation via the Joule effect. D.R.Barber

523.75

9154. A SOLAR OUTBURST IN Hα EMISSION. S.O.Obashev.

Dokl. Akad. Nauk SSSR, Vol. 124, No. 4, 786-7 (1959). In Russian.

A narrow emission line at a distance of 16 A on the violet side of the Hα line appeared on the middle one of three spectrograms taken with a coronal spectrograph, on 31 October 1957. Its position corresponds to a stream of ejected matter moving with a velocity greater than the parabolic velocity at the surface of the sun. Linear dimensions of the ejected material are roughly 10^{10} cm. The density of the associated stream at the earth's surface is probably less than 1 atom of hydrogen per cm^3. The results confirm Mustel's conjecture [Contr. Crimean Astrophys. Obs., Vol. 3 (1948)].
G.A.Chisnall

523.75

9155. THE GREAT FLARE OF 3 JULY 1957. W.Comper.

Z. Astrophys., Vol. 47, No. 1, 34-43 (1959). In German.

Central and equivalent widths of Hα profiles, as measured on 10 spectrograms of the 3+ flare, are listed, and a development curve is reproduced. The various ionospheric effects accompanying the outbreak are enumerated and briefly discussed. D.R.Barber

523.755

**9156. A NEW THEORY OF THE SOLAR CORONA.
P.J.Kellogg and E.P.Ney.**

Nature (London), Vol. 183, 1297-301 (May 9, 1959).

From a discussion of the known experimental facts it is considered that the most probable model of the corona, as an alternative to the orthodox hydrostatic equilibrium concept, is one in which the corona consists of trapped charged particles moving in the solar magnetic fields. The physical picture is very similar to that visualized for the newly-discovered Van Allen radiation field surrounding the earth. D.R.Barber

523.77

9157. ON THE LINES OF TECHNETIUM IN THE SOLAR SPECTRUM. II. A.A.Nikitin.

Astron. Zh., Vol. 35, No. 3, 366-71 (1958). In Russian. English translation in: Soviet Astron — AJ (New York), Vol. 2, No. 3, 338-42 (May-June, 1958).

For Pt I, see Abstr. 6600 (1958). Unidentified solar lines whose wavelengths are close to those of Tc lines are compared with lines due to molecular compounds which are most abundant in the solar atmosphere. It is shown that most of the lines λ 5620.42, 5589.01, 4238.24, 3636.05 and 3195.23 do not coincide with lines due to C_2, O_2, OH, CH, and other molecules.

523.77

9158. THEORETICAL AND OBSERVED EQUIVALENT WIDTHS OF SOME STRONG LINES IN THE SUNSPOT SPECTRA.
V.S.Berdichevskaya.
Astron. Zh., Vol. 35, No. 5, 730-8 (1958). In Russian.

523.8 : 523.164.4

9159. EXPLORATION OF THE NEARBY GALAXIES BY OPTICAL AND RADIO METHODS. [L'Exploration des galaxies voisines par les methodes optiques et radio-electriques.]. G. de Vaucouleurs.
Paris : Masson et Cie (1958) 151 pp. [Collection Evolution des Sciences, No. 13]. In French.

This volume presents in a style suited to the non-specialized reader a factual review of our present knowledge concerning the physical characteristics of those galaxies sufficiently close to our own to make possible detailed optical and radio observations. The subject-matter is divided into seven main sections, viz., (i) introduction and generalities; (ii) morphology and classification; (iii) distance indicators; (iv) luminosities and dimensions; (v) spectra, colours and polarization; (vi) radio radiation; (vii) rotation and masses. The text is illustrated with 47 diagrams, 6 tables and 18 plates. Separate name and subject indexes are included, with one short bibliography of four monographs intended for general reference. D.R.Barber

523.8

9160. THE SOURCE OF STELLAR ENERGY. A.Masani.
Nuovo Cimento Suppl., Vol. 11, No. 1, 92-124 (1959). In Italian.

A review of developments in the theory of the origin of energy in stars with many references to recent papers. R.A.Newing

523.852

9161. PRODUCTION OF THE MAGNETIC FIELD OF THE CRAB NEBULA. L.Marshall.
Nuovo Cimento, Vol. 12, No. 5, 477-82 (June 1, 1959).

The magnetic field of the Crab Nebula is so large that if the original pre-super nova star had contained it, it must have been on the verge of instability. It is suggested here that this magnetic field did not exist before the explosion which produced the Crab, but was created from the kinetic energy of the expanding matter. To account for the observed magnetic field of $\sim 10^{-3}$ G a mechanism is proposed which derives from the existence of shock waves in the exploding shell, from the existence of charge separation in the shock fronts, and from the formation of irregularities in the surfaces where charge separations exist, at some time during their propagation from regions of very high density in the star interior out into the very low galactic density. The magnetic field of 10^{-3} G, now believed to exist in the Crab, follows from the present theory, if one assumes the experimental value of $10^{3}/\mathrm{cm}^{3}$ for the density in the filaments.

523.852.3 : 523.164.4

9162. THE EVOLUTION OF EXTRAGALACTIC NEBULAE AND THE ORIGIN OF METAGALACTIC RADIO EMISSION.
G.R.Burbidge.
Phil. Mag. (Eighth Ser.), Vol. 3, 1327-8 (Nov., 1958).

A note in reply to paper by Bruce (Abstr. 6602/1958) with above title. The author supports synchroton mechanism as an explanation of non-thermal radiation from the well known radio source identified with M87, as opposed to the electric discharge mechanism proposed by Bruce. C.Hazard

523.852.3 : 523.164.4

9163. THE EVOLUTION OF EXTRAGALACTIC NEBULAE AND THE ORIGIN OF METAGALACTIC RADIO EMISSION. C.E.R.Bruce.
Phil. Mag. (Eighth Ser.), Vol. 3, 1328-9 (Nov., 1958).

A reply to a criticism by Burbidge (see preceding abstract) of a paper of the above title (Bruce, Abstr. 6602 of 1958), in which the author proposed an electric discharge mechanism as the origin of the radio emission from the elliptical nebula M87. C.Hazard

523.87

9164. ON THE POLARIZED LIGHT IN THE EMISSION LINES EXCITED BY THE SYNCHROTRON RADIATION OF RELATIVISTIC ELECTRONS IN VARIABLE STARS. I.M.Gordon and L.D.Pichakhchi
Dokl. Akad. Nauk SSSR, Vol. 120, No. 1, 55-8 (May 1, 1958).
In Russian. English translation in: Soviet Physics — "Doklady" (New York), Vol. 3, No. 3, 484-7 (May-June, 1958).

The depolarization is considered of hydrogen emission lines when linearly polarized synchrotron radiation is scattered under various conditions by excited atomic hydrogen. The calculations, which are given in detail for the Hα line, are also applicable to other lines, the depolarization of scattered light depending only on the state of symmetry of the scattering atom and not on the frequency of the light. R.A.Newing

523.87

9165. SOME VALUES OF THE INTENSITIES OF HELIUM LINES IN THE SPECTRA OF NON-STATIONARY STARS. A.A.Nikitin.
Dokl. Akad. Nauk SSSR, Vol. 121, No. 6, 991-3 (1958). In Russian.

A brief theoretical investigation of the changes of intensity of helium lines associated with the 2^3S metastable state. The number of He atoms in this state is given exactly when the electron density is constant, and approximately when it is variable. G.A.Chisnall

523.872

9166. THE CALIBRATION OF THE GRADIENT (SPECTROPHOTOMETRIC) STELLAR TEMPERATURE SCALE BY REFERENCE TO THE SUN. O.A.Mel'nikov.
Astron. Zh., Vol. 35, No. 2, 218-21 (1958). In Russian. English translation in : Soviet Astron — AJ (New York), Vol. 2, No. 2, 195-8 (March-April, 1958).

The star 85 Pegasi is analogous to the sun (G2V + $4^{M}.73$) as its class is G2V and its luminosity is $M_V = +4^{M}.7$. Using Abbot's observations reduced by Minnaert with a scale correction of 2.4%, the absolute spectrophotometric gradient (according to the flux) for the whole sun was found to be equal to 2.44. This gradient was adopted also for 85 Pegasi. This star, as well as ϵ Ursae Majoris and α Lyrae, is included in the six-colour photometry of Stebbins and others, and therefore it was possible to determine the relative gradient of the mean of the two A0 stars relative to G2V. It was found to be −1.29. Consequently for type A0 stars: A0 : $\Phi(A0) = 1.15$ with $\bar{\lambda} = 0.5705\mu$, whence T (A0) = 15 600° K. The derived value coincides completely with that calculated by the author and Kienle by other methods in 1955/56 and 1941, respectively.

523.877 : 523.75

9167. ON THE COOLING OF STELLAR MATERIAL BY THERMAL EMISSION AND THE FADING OF SOLAR ERUPTIONS.
L.Oster.
Z. Astrophys., Vol. 44, No. 1, 26-36 (1957). In German.

Estimates of the rate of cooling are made for the temperature range 4000° to 10 000° K and the pressure range $\log p_g = 2$ to 8. Observations of the fading of solar eruptions are interpreted in terms of cooling processes in super-heated regions. R.A.Newing

525.3 : 551.513

9168. ATMOSPHERIC TIDES AND EARTH SATELLITE OBSERVATIONS. D.G.Parkyn and G.V.Groves.
Nature (London), Vol. 183, 1045-7 (April 11, 1959).

It is shown that variations in the periodic times for earth satellites can be explained by extending the concept of atmospheric tidal resonance to the third and fourth harmonic terms. An additional frequency component in the periodicity of 1958α can be explained by invoking an equatorial bulge in the earth's atmosphere. H.J.A.Chivers

PHYSICS

GRAVITATION . RELATIVITY

530.12

9169. THEORY OF RELATIVITY. W.Pauli. (Translated by G.Field).
London; New York; Paris; Los Angeles : Pergamon Press (1958) xiv + 241 pp.

Although first published in 1921 as an article in Encyklopädie der mathematischen Wissenschaften under the title "Relativitätstheorie" and later as a separate monograph, Pauli's treatise still remains one of the most exhaustive accounts of the theory of relativity. That it should form the basis of the present work must reflect partly on how little the subject has advanced since its general principles were first enunciated by Einstein, and partly on the comprehensive nature of the work. For this first English edition the original text is retained, but it was brought up to date by Pauli by the addition of Supplementary Notes. Among the many books on relativity, Pauli's is distinguished by a profound familiarity with the most subtle points in the theory and with the extensive literature. Though essentially a formal mathematical account the physics is kept well to the fore and there is always close contact between theory and experiment. The general arrangement of the text is one that has been followed by many later authors, so that it could now reasonably be described as standard. After the usual historical preliminaries, a large section is devoted to mathematical requirements, followed by the presentation of the special and the general theories as the invariant theories of the Lorentz group and of the group of all point transformations, respectively. The main work concludes with a discussion of the unified field theories of Mie, Weyl and Einstein. The Supplementary Notes, which are intended to be read in conjunction with the text, give selected information on later developments and also the author's views on some controversial questions. Pauli makes no attempt to conceal his disagreement with Einstein on certain points and, in particular, his scepticism of unified field theories. The book includes a wealth of detail, lucidly analysed and supported by copious references, and the evolutionary nature of the presentation is achieved without any pruning of the material or loss of historical continuity. T.R.Carson

530.12

9170. EQUATIONS OF MOTION OF ROTATING BODIES IN GENERAL RELATIVITY THEORY. W.Tulczyjew.
Acta phys. Polon., Vol. 18, No.1, 37-55 (1959).

Derives of the approximate equations of motion for a system of two rotating bodies treated as singularities of gravitational field. Use is made of the method given by Infeld (1954). Also, the equations of motion are integrated and a new relativistic effect is obtained: motion of the equinoxes at a constant angular velocity.

530.12

9171. THE EQUATIONS OF MOTION AND THE COORDINATE CONDITIONS IN THE RELATIVISTIC PROBLEM OF N BODIES. V.A.Brumberg.
Astron, Zh., Vol. 35, No. 6, 893-903 (1958). In Russian.

The aim of the investigation was the derivation of the equations of motion in an arbitrary coordinate system. At each stage of the approximation method of Einstein, Infeld and Hoffman, four arbitrary functions were introduced into the expression for the gravitational potential and their influence on the form of the equations of motion was investigated. It is proved that the equations of motion do not depend on the introduced arbitrary functions. The motion of a test particle in the field of N bodies is considered.

530.12 : 538.3

9172. THE EQUATIONS OF MOTION IN LINEAR FIELD THEORIES. C.Jankiewicz.
Bull. Acad. Polon. Sci. Ser. Sci. math. astron. phys., Vol. 7, No. 3, 175-8 (1959). In German.

Using the electromagnetic field as an example, it is shown how one can derive both the field equations and the equations of motion of its sources from the conditions defining the system of reference and from a variational principle. The variation of the action integral is performed with respect to both the potentials and the functions defining the system of reference. P.Roman

530.12

9173. PRINCIPLE OF A UNIFIED THEORY. INTERPRETATION BASED ON THE USE OF A HYPERSURFACE OF A FIVE-DIMENSIONAL SPACE. M.Lenoir.
C.R.Acad. Sci. (Paris), Vol. 248, No. 14, 2074-5 (April 6, 1959). In French.

The geometry of a sub-space V^4 of a differential variety V^5 based on a linear connection permits an extension of the relativistic group and leads to a system of field equations derived from a variational principle. The equations of Einstein–Schrödinger, of Tonnelat and of Bonnor are recovered as particular cases. T.R.Carson

530.12

9174. SOME REMARKS ON THE PETROV CLASSIFICATION: CASE 2. L.Bel.
C.R. Acad. Sci. (Paris), Vol. 248, No. 18, 2561-3 (May 4, 1959). In French.

In cases 2 and 3 there exists an isotropic vector l such that

$$R_{\alpha\beta,\lambda\mu}l^{\alpha}l^{\lambda} = Kl_{\beta}l_{\mu};\ \overset{*}{R}_{\alpha\beta,\lambda\mu}l^{\alpha}l^{\lambda} = \overset{*}{K}l_{\beta}l_{\mu}$$

In the former case the trajectories of l are isotropic geodesics of the metric. T.R.Carson

530.12

9175. ON A GENERAL SOLUTION OF EINSTEIN'S INTERIOR EQUATIONS FOR A GROUP MOVEMENT. C.B.Rayner.
C.R. Acad. Sci. (Paris), Vol. 248, No. 19, 2725-7 (May 11, 1959). In French.

An explicit form for a solution of Einstein's interior equations which also satisfies the equations of Killing is deduced from a simple form of the Einstein equations under conditions of rigid motion. T.R.Carson

530.12

9176. NOTE ON MØLLER'S ENERGY-MOMENTUM PSEUDO-TENSOR. B.E.Laurent.
Nuovo Cimento, Vol. 11, No. 5, 740-2 (March 1, 1959).

Møller has derived the tensor by varying the scalar curvature density with respect to the $g^{\mu\nu}$ and their first and second derivatives. It is noted here that results may be obtained more simply by variation with respect to $(-g)^{\frac{1}{2}}g^{\mu\nu}$, $\Gamma^{\alpha}{}_{\beta\gamma}$ and $\Gamma^{\alpha}{}_{\beta\gamma,\delta}$. R.A.Newing

530.12

9177. FACTOR SEQUENCES IN QUANTIZED GENERAL RELATIVITY. J.L.Anderson.
Phys. Rev., Vol. 114, No. 4, 1182-4 (May 15, 1959).

The problem of the order of factors in the constraint equation of general relativity has been investigated. Although the constraints plus Hamiltonian form a factor group in the nonquantized version of the theory, it does not follow directly that they will do so in the quantized version. The difficulty lies in the fact that the commutator of two expressions depends upon the order of factors chosen for them. The author has explicity exhibited a class of factor sequences for the constraints such that they do indeed form a factor group.

530.12

9178. THE APPARENT SHAPE OF A RELATIVISTICALLY MOVING SPHERE. R.Penrose.
Proc. Cambridge Phil. Soc., Vol. 55, Pt 1, 137-9 (Jan., 1959).

It is shown that the appearance of a sphere, no matter how it is moving, is always such as to present a circular outline to any observer. T.R.Carson

530.12

9179. THE SPHERICALLY-SYMMETRICAL SOLUTION FOR SCALAR MESONS WITH ZERO MASSES, IN THE PROJECTIVE RELATIVITY THEORY. J.Petzold.
Z. Naturforsch., Vol. 14a, No. 3, 205-7 (March, 1959). In German.

The complete, static solution is derived and discussed, particularly the radial dependence of the components g_{00} and g_{11} of the metric tensor; it is found that no singularity-free solution exists. J.K.Skwirzynski

530.12

9180. RELATIVITY AND SPACE TRAVEL. J.R.Pierce.
Proc. Inst. Radio Engrs, Vol. 47, No. 6, 1053-61 (June, 1959).

This paper treats, in terms of the special theory of relativity:

a "clock paradox" involving the fact that the frequency of an atomic oscillator on a moving body is lowered but the mass which is converted into radiation is increased; the case of the twin who goes on a space trip at near-light speed and returns younger than his brother on earth; the shift in frequency in the presence of a gravitational field; the clock rate on a satellite; the speed attainable by a photon rocket; and a space ship propelled by the energy of interstellar matter.

530.12

9181. RELATIVISTIC CLOCK EXPERIMENTS. E.T.Jaynes.

Amer. J. Phys., Vol. 26, No. 3, 197-8 (March, 1958).

In a qualitative discussion it is maintained that there must be agreement between quantum and relativistic theory as regard to frequencies and time scales. Any new gravitational effect, additional to that predicted by relativity, would be inconsistent with quantum theory. R.A.Newing

530.12 : 532.5

9182. QUADRATIC LAGRANGIANS IN RELATIVISTIC HYDRODYNAMICS. F.Halbwachs, P.Hillion and J.P.Vigier.

Nuovo Cimento, Vol. 11, No. 6, 882-3 (March 16, 1959).

By means of a relativistic generalization of the inertia tensor it is possible to construct a Lagrangian quadratic in the angular velocity for which the non-relativistic approximation gives the classical quadratic expression for the rotation energy density. T.C.Carson

530.12

9183. HYDRODYNAMICAL ANALOGY TO $E = mc^2$. V.P.Starr.

Tellus, Vol. 11, No. 1, 135-8 (Feb., 1959).

In a qualitative discussion of gravity waves, it is noted that the total energy E per wavelength cannot exceed mc^2, where m is the horizontal mass transport per wave period and c is the wave velocity. R.A.Newing

530.12 : 538.3

9184. CHARGED FLUIDS OF INFINITE CONDUCTIVITY. Y.Fourés-Bruhat.

C.R. Acad. Sci. (Paris), Vol. 248, No. 18, 2558-60 (May 4, 1959).

The Maxwell tensor for a charged fluid without induction ($\epsilon\mu = 1$) is written down and generalized to the case of a dielectric and magnetic body of permittivity ϵ and permeability μ. The shock equations are derived and the wave-fronts and velocities of propagation in fluids of infinite conductivity determined. T.R.Carson

530.12

9185. A NEW EXPRESSION FOR EINSTEIN'S LAW OF GRAVITATION. D.J.Newman and C.W.Kilmister.

Proc. Cambridge Phil. Soc., Vol. 55, Pt 1, 139-41 (Jan., 1959).

Defining the contravariant vectors and the coefficients of affine connection by the equations

$$\mathcal{E}^{\mu} = g^{\mu\nu}\,\mathcal{E}_{\nu}$$
$$\mathcal{E}_{\mu,\nu} = \Gamma^{\sigma}_{\mu\nu}\,\mathcal{E}_{\sigma} \qquad (\Gamma^{\sigma}_{\underset{\mathrm{v}}{\mu\nu}} = 0)$$

it is shown that

$$\mathcal{E}^{\nu\sigma}_{\mathrm{v}}\;\mathcal{E}_{\mu,[\nu\sigma]} = 0,$$

where the square brackets denote the anti-symmetric combination, is equivalent to the equation $R_{\alpha\beta} = 0$. T.R.Carson

530.12

9186. ELECTROMAGNETIC AND GRAVITATIONAL WAVES AND RADIATIONS. A.Lichnerowicz.

C.R. Acad. Sci. (Paris), Vol. 248, No. 19, 2728-30 (May 11, 1959). In French.

The equations of propagation in general relativity of the discontinuities of the curvature tensor and the derived tensor of the electromagnetic field are deduced. T.R.Carson

530.12 : 538.3

9187. CONSERVATION LAWS FOR ACTION IN ELECTROMAGNETIC AND GRAVITATIONAL RADIATION FIELDS. J.Ehlers and R.K.Sachs.

Z. Phys., Vol. 155, No. 4, 498-506 (1959). In German.

Two generally covariant integral conservation laws, concerning electromagnetic null fields and vacuum gravitational fields of type II with vanishing Riemann-eigenvalue, respectively, are proved. Both the conserved quantities have the dimensions of action. The electromagnetic law shows that, with respect to the propagation of energy, a null field may be represented by a stream of photons. The gravitational conservation theorem is, in many respects, similar to the electromagnetic one; it admits the calculation of the change of intensity along a gravitational ray.

530.12

9188. GEOMETRICAL SIGNIFICANCE OF THE EINSTEIN–MAXWELL EQUATIONS. G.Rosen.

Phys. Rev., Vol. 114, No. 4, 1179-81 (May 15, 1959).

Rainich geometries are analysed in terms of the invariants associated with the Ricci vierbein of principal directions. At any point the four unit vectors of the vierbein pair off into two blades which contain the maxima and minima directions of mean curvature, respectively. The blades can "mesh" into smooth integral surfaces for certain electromagnetic fields. In general, neighbouring blades are shown to be related by only two independent differential conditions.

530.12 : 531.51

9189. FIXATION OF COORDINATES IN THE HAMILTONIAN THEORY OF GRAVITATION. P.A.M.Dirac.

Phys. Rev., Vol. 114, No. 3, 924-30 (May 1, 1959).

The theory of gravitation is usually expressed in terms of an arbitrary system of coordinates. This results in the appearance of weak equations connecting the Hamiltonian dynamical variables that describe a state at a certain time, leading to supplementary conditions on the wave function after quantization. It is then difficult to specify the initial state in any practical problem. To remove the difficulty one must eliminate the weak equations by fixing the coordinate system. The general procedure for this elimination is here described. A particular way of fixing the coordinate system is then proposed and its effect on the Poisson bracket relations is worked out.

530.12

9190. ON THE ENERGY EQUATION FOR A GRAVITATING TEST PARTICLE. C.Cattaneo.

Nuovo Cimento, Vol. 11, No. 5, 733-5 (March 1, 1959).

The equations of motion can be given a Newtonian form by the introduction of suitable "standard" quantities relative to a chosen system of reference, and the use of a generalized absolute differentiation (Abstr. 2032 of 1959). The "standard effective relative energy" is now defined, the time rate of change of which is shown to be equal to the instantaneous power of the gravitational force, together with a term arising from the dependence on time of the system of reference. For a stationary reference system it is possible to define a "total relative energy" which is a constant of motion. R.A.Newing

530.12

9191. THE COORDINATE CONDITIONS IN EINSTEIN'S THEORY OF GRAVITATION. I.G.Fikhtengol'ts.

Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1457-65 (1958). In Russian.

Some relations are derived connected with covariance of the field equations under a transformation of the variables are derived. The relation between the coordinate conditions and invariance of the field Lagrangian is established. The geometrical and physical properties of coordinate systems corresponding to the coordinate conditions thus derived are considered.

FIELD THEORY . QUANTUM THEORY

530.145

9192. FIELD EQUATIONS FOR NONLOCALIZABLE FIELDS. G.Heber.

Nuovo Cimento, Vol. 12, No. 6, 553-63 (June 16, 1959). In German.

In the special cases of a real, scalar field and of electrodynamics the conventional, differential field equations are substituted by covariant integral laws. These integral equations are then modified in such a manner that they accord with the possibilities of measurement. The modified integral equations are then once more changed to differential field laws. It is shown that for the scalar field these equations are different from the conventional ones, but for electrodynamics identical field equations are obtained. However the meaning of the field quantities does change by this modification and as a result commutation relations are obtained between the new field quantities, which are no longer c-numbers; they are certain q-numbers. The meaning of this fact is still an open question. In the appendix a short discussion about critical points of the series of papers which led to this work is given.

530.145

9193. CRITICISM OF VON NEUMANN'S PROOF OF ACAUSALITY IN QUANTUM MECHANICS. G.Schulz.
Ann. Phys. (Leipzig), Vol. 3, No. 1-2, 94-104 (1959). In German.

Von Neumann's famous proof (1930) of the indeterminism of quantum mechanics is analysed and it is shown that the proof contains a logical flaw. In addition, Feyerabend's view (Abstr. 7159 of 1956) is also criticized. P.Roman

530.145

9194. ON THE MOTION OF THE FIELD SINGULARITIES IN COVARIANT FIELD THEORIES. C.Jankiewicz.
Bull. Acad. Polon. Sci. Ser. Sci. math. astron. phys., Vol. 6, No. 12, 771-4 (1958). In German.

Considering discontinuous δ-function sources, it is shown that the equations of motion of the sources, derived from the field equations, go over into those of the field singularities. As distinct from the results of Bergman (Abstr. 2336 of 1949) and of Goldberg (Abstr. 2182 of 1953), they are of the form of Euler—Lagrange equations of a variation principle. W.A.Hepner

530.145

9195. APPLICATION OF THE METHOD OF W.RITZ IN THE QUANTUM THEORY OF FIELDS. N.S.Kalitzin.
C.R. Acad. Bulg. Sci., Vol. 10, No. 1, 5-8 (Jan.-Feb., 1957). In German.

By deriving the Tamm—Dancoff equations from a variational principle, it is shown that the Ritz method may be used also in the quantum theory of fields. P.Roman

530.145

9196. ON A CLASSICAL MODEL OF INDEFINITE METRIC. B.V.Medvedev and M.K.Polivanov.
Dokl. Akad. Nauk SSSR, Vol. 121, No. 4, 623-6 (1958). In Russian.

The purpose of this paper is to elucidate on a model, constructed in the framework of classical field theory, a previously developed method (Bogolyubov, Medvedev and Polivanov) for utilizing an indefinite metric in problems of quantum field theory. In particular, it is shown that the exclusion of the "non-physical" fields leads to an essentially non-local interaction. P.Roman

530.145

9197. ON THE QUESTION OF CAUSALITY IN A THEORY WITH INDEFINITE METRIC. D.A.Slavnov and A.D.Sukhanov.
Dokl. Akad. Nauk SSSR, Vol. 124, No. 6, 1229-32 (1959). In Russian.

Causality requirements are examined for a theory with an indefinite metric. By a special choice of the non-physical part of the field, an S-matrix can be constructed, which satisfies causality and unitarity to the third order in perturbation. But in the fourth order, it is stated that unitarity and causality requirements cannot be met simultaneously. The case of non-perturbative expansions is left open. J.Lascoux

530.145

9198. CAUSALITY IN QUANTUM FIELD THEORY. S.T.Ma.
Nuclear Phys., Vol. 11, No. 4, 696-9 (June (2), 1959).

Previous work (Abstr. 4718 of 1959) is extended to cover all the virtual particles of any scattering process.

530.145

9199. ISOTOPIC BI-SPACE THEORY. I. REPRESENTATION OF THE WAVE-FUNCTIONS. R.Zaikov.
C.R. Acad. Bulg. Sci., Vol. 11, No. 3, 189-92 (May-June, 1958). In German.

In the interaction between baryons and K-mesons, the four-dimensional iso-space theory of Salam—Polkinghorne loses its invariant character because the symmetry of the four-momentum is destroyed by the interaction. To escape this difficulty it is proposed to represent the wave-functions of elementary particles in terms of two different three-dimensional iso-spaces. T.R.Carson

530.145

9200. ISOTOPIC BI-SPACE THEORY. II. STRONG INTERACTIONS. R.Zaikov.
C.R. Acad. Bulg. Sci., Vol. 11, No. 4, 259-62 (July-Aug., 1958). In German.

Expressions are given for the interaction Hamiltonian, charge and number density in the case of strong coupling involving baryons and K-mesons using wave-functions represented in terms of two different three-dimensional iso-spaces. T.R.Carson

530.145 : 535.37

9201. ABSORPTION AND LUMINESCENCE OF A HARMONIC OSCILLATOR. B.I.Stepanov and V.P.Gribkovskii.
Dokl. Akad. Nauk SSSR, Vol. 121, No. 3, 446-9 (1958). In Russian.

A quantum-mechanical calculation is developed for the power of light absorption and luminescence in the case of a linear harmonic oscillator. It is found that all conclusions arrived at on the basis of classical theory and relating to the integral absorption and luminescence of a harmonic oscillator coincide with those obtained from the quantum theory. F.Lachman

530.145

9202. A REMARK ON ONE-DIMENSIONAL QUANTUM ELECTRODYNAMICS. V.Glaser and B.Jakšić.
Nuovo Cimento, Vol. 11, No. 6, 877-9 (March, 1959).

The one-dimensional quantum electrodynamics with zero mass electrons is shown to be equivalent to the Thirring model, with which it is connected by a gauge transformation. T.R.Carson

530.145

9203. PHOTON WAVE EQUATIONS. A.A.Borgardt.
Zh. eksper. teor. Fiz., Vol. 34, No. 5, 1323-5 (May, 1958). In Russian. English summary: PB 141052T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Using Dirac algebra methods previously developed by the author, a wave equation is obtained for the photon which is analogous to the Lee and Yang equation for zero mass fermions. In this way it is possible to avoid many of the difficulties associated with the quantization of the electromagnetic field and, in particular, to treat the interaction of photons and gravitons. E.J.Squires

530.145

9204. ON A VARIATIONAL PRINCIPLE IN THE MANY-BODY PROBLEM. S.V.Tyablikov.
Dokl. Akad. Nauk SSSR, Vol. 121, No. 2, 250-2 (1958). In Russian.

The Lagrange method of undetermined multipliers is used to formulate the total Hamiltonian for a system of interacting particles, subject to the ancillary conditions of energy and charge conservation. Particle and parity conservation are not postulated. J.W.Gardner

530.145

9205. NON-LOCAL INTERACTION AND UNIVERSAL CUT-OFF. E.Arnous and W.Heitler.
Nuovo Cimento, Vol. 11, No. 3, 443-6 (Feb. 1, 1959).

A relativistic cut-off prescription proposed earlier (Abstr. 2644 of 1956) is reformulated in terms of a non-local interaction with an invariant form factor. This bears some resemblance to one suggested earlier by Møller and Kristensen, but possesses the advantage that it ensures convergence in all cases. P.K.Kabir

530.145

9206. NOTE ON PARITY VIOLATION IN STRONG INTERACTIONS. B.d'Espagnat and J.Prentki.
Nuovo Cimento, Vol. 12, No. 2, 164-6 (April 16, 1959).

A suggestion, in general terms, how parity violation in strange-particle strong interactions could be reconciled with very weak parity violation in nuclear phenomena. The suggestion, however, carries with it the difficulty of understanding the near equality of the $\Sigma^{\pm}$ and Σ^{0} masses. J.C.Taylor

530.145

9207. ON THE UNIVERSAL FERMI INTERACTION. W.Królikowski.
Nuclear Phys., Vol. 11, No. 4, 687-90 (June (2), 1959).

A formalism proposed previously (Abstr. 1080 of 1959) for elementary particles enables one to express the universal Fermi interaction between fermions in a concise form.

530.145

9208. INTERACTION OF CHARGED PARTICLES WITH A DEGENERATE FERMI—DIRAC ELECTRON GAS. R.H.Ritchie.
Phys. Rev., Vol. 114, No. 3, 644-54 (May 1, 1959).

Expressions for the self-energy and interaction probability of charged particles in a degenerate Fermi—Dirac electron gas are given, generalizing from the dielectric theory of Lindhard and Hubbard and treating interactions between electrons in the gas by first-order perturbation theory. Numerical results for the interaction probability in a particular case are presented. A more general Feynman diagrammatic analysis of interaction in the gas is carried out, yielding results in agreement with the more elementary approach.

530.145 : 539.2

FIELD THEORY OF A DEGENERATE ELECTRON GAS. See Abstr. 8835

530.145

9209. SPACE TIME PROPERTIES AND INTERNAL SYMMETRIES OF STRONG INTERACTIONS. G.Feinberg and F.Gürsey.
Phys. Rev., Vol. 114, No. 4, 1153-70 (May 15, 1959).

Theorems relating the separate conservation of C and P in pion-nucleon interactions to CP invariance, the form of the interaction and the existence of a charge symmetry operation are generalized to other strong interactions. It is shown that the minimal conditions for the derivation of such results are the existence of a doublet structure for baryons and invariance under certain transpositions of the baryons that may be interpreted as generalized charge symmetries relating the different doublets and may be represented by reflection operations in an internal 4-dimensional space. If charge independence is also valid, highly symmetrical Yukawa couplings are obtained. The problem of the disagreement with experiment of such symmetric structures is analysed in terms of additional quadrilinear interactions with lower symmetries which also possess the property that P invariance follows from invariance under CP. Various examples of such interactions are given. The possible application of the approximate symmetry principles considered to the weak interactions is briefly indicated.

530.145 : 537.56

9210. COLLECTIVE MOTION IN A SYSTEM OF QUASI-PARTICLES. P.S.Zӯryanov.
Zh. eksper. teor. Fiz., Vol. 34, No. 2, 508-9 (1958). In Russian. English summary: PB 141052T-1, obtainable from Office of Technical Services, U.S.Dept. of Commerce, Washington, D.C., U.S.A.

In the self-consistent field approximation, the effect of strong interactions leads to a dependence of single particle (or quasi-particle) energies on the states of the other particles of the system. This gives rise to a complicated relation between the energy of the particle and its momentum. It is suggested that the momentum can be separated into two parts, one (p) being the momentum which is more properly associated with collective motion of the particles. In cases where |p| is small the energy can be expanded in powers of |p| and only the lowest term retained. In this way an equation for the collective motion is obtained. Application of the method to plasma oscillations is suggested. E.J.Squires

530.145

9211. ON THE THEORY OF DISPERSION RELATIONS. S.M.Bilen'kii.
Zh. eksper. teor. Fiz., Vol. 34, No. 2, 518-19 (1958). In Russian. English summary: PB 141052T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

This extends a previous study (Abstr. 2789 of 1958) of dispersion relations for weak interactions, by applying it to non-local interactions between weakly interacting particles. J.C.Taylor

530.145

9212. TWO CLASSES OF INTERACTION LAGRANGIANS. V.G.Solov'ev.
Zh. eksper. teor. Fiz., Vol. 34, No. 5, 1335-6 (May, 1958). In Russian. English summary: PB 141052T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The forms of baryon-meson interaction which are invariant under isotopic spin transformations are discussed.

R.J.N.Phillips

530.145

9213 γ_5-INVARIANCE AND PARITY CONSERVATION IN STRONG INTERACTIONS. G Kramer, H.Rollnik and B.Stech.
Z. Phys., Vol. 154, No. 5, 564-8 (1959). In German.

It is shown that it is possible to construct parity conserving baryon–pion interactions which are γ-invariant in exactly the same manner as electro–magnetic and weak interactions.

530.145

9214. EXACT SOLUTIONS FOR THE DIPOLE RADIATION OF THE HARMONIC OSCILLATOR. W.C.Henneberger.
Z. Phys., Vol. 155, No. 3, 296-312 (1959). In German.

As was shown by Bloch (Abstr. 1259 of 1928) and by Bauer and Jensen (Abstr. 1691 of 1949), a Schrödinger wave-packet, retaining its shape but performing a damped oscillation, may be found for an elastically bound electron when dipole radiation is taken into account. This result is rederived using the principal axis transformation of the Hamiltonian for this problem as given by Van Kampen (Abstr. 4142 of 1952). Moreover, the radiative decay of the first and higher excited states of the harmonic oscillator is treated in dipole approximation by the same method. One finds, besides the well-known results, that multiple quantum emission does not occur. No perturbation theory is used in any of the calculations.

530.145

9215. ADDENDUM TO A NOTE ON STATISTICAL TENSORS IN QUANTUM MECHANICS. L.C.Biedenharn.
Ann. Phys. (New York), Vol. 6, No. 4, 399-400 (April, 1959).

See Abstr. 4712 (1958).

530.145

9216. CONFORMAL THEORY IN C_6 OF THE PARTICLE WITH MAXIMUM SPIN 2. A.Popovici.
C.R.Acad. Sci. (Paris), Vol. 248, No. 4, 528-30 (Jan. 26, 1959). In French.

Riemannian equations for the particle of maximum spin 2 are derived from a conformal invariant Lagrangian. The linear terms give the classical equations of De Broglie. [Théorie générale des particules á spin. L. de Broglie (2nd ed.). Paris (1954)].

J.Lascoux

530.145

9217. CONFORMAL THEORY IN C_4 OF THE PARTICLE WITH MAXIMUM SPIN 2.
A.Popovici, I.Teodoresco and G.Margulesco.
C.R.Acad. Sci. (Paris), Vol. 248, No. 11, 1610-12 (March 16, 1959). In French.

Continuation of preceding abstract. In C_4, equations for states of spin 2, 1, 0 are obtained and discussed. J.Lascoux

530.145

9218. LAGRANGIAN FORMALISM FOR AN ISOLATED EXTENDED RELATIVISTIC PARTICLE.
F.Halbwachs and J.P.Vigier.
C.R. Acad. Sci. (Paris), Vol. 248, No. 7, 934-7 (Feb. 16, 1959). In French.

Weyssenhoff's equations are derived again for the case mentioned in the title. J.Lascoux

530.145

9219. QUANTUM MECHANICAL CHARACTERISTICS AND ELEMENTARY PARTICLES. R.Zaikov.
C.R. Acad. Bulg. Sci., Vol. 10, No. 2, 101-3 (March-April, 1957).

A classification of baryons and leptons based on a four-dimensional isotopic spin space. J.C.Taylor

530.145

9220. ON THE TRANSFORMATION FUNCTIONS OF PARTICLES WITH ARBITRARY SPIN. Yu.I.Kulakov.
C.R. Acad. Bulg. Sci., Vol. 10, No. 2, 105-8 (March-April, 1957). In Russian.

It is shown that the transformation function of the radial part of the wave functions, which carries over from the x-representation to the p-representation, does not depend on the spin properties of the particles and is completely determined through their orbital angular momenta. P.Roman

530.145 : 539.12

9221. A SYMMETRICAL FORM OF THE NUCLEON EQUATION. R.Zaikov.
Izv. Bulg. Akad. Nauk., Vol. 6, 3-9 (1956; publ. 1957). In Bulgarian with summary (1 p.) in German.

The four-dimensional Minkowski space and the three-dimensional isospace are joined to form a seven-dimensional Euclidean space in which there are defined 8 × 8 matrices, acting on an eight-component spinor. A field equation is set up, which is claimed to describe the nucleon, including its interactions.

P.Roman

530.145

9222. THE DIRAC THEORY OF THE ELECTRON IN GENERAL RELATIVITY THEORY. O.Klein.
K. Norske Vidensk. Selsk. Forhandl., Vol. 31, No. 8, 47-51 (1958 : publ. 1959).

A modification of the Fock, Schrödinger and Bargmann generally relativistic treatment of the Dirac theory is given. An expression

r the covariant Feynman exponent for a spinor field of zero rest
ass is studied and its invariance against general coordinate
ansformations demonstrated. T.R.Carson

530.145

23. ON THE DIRAC EQUATION FOR BARYONS.

Dallaporta and T.Toyoda.
ovo Cimento, Vol. 12, No. 6, 593-601 (June 16, 1959).

Making use of physical considerations, possible forms of direct
teraction between baryons and other fields in Gürsey's equation
ve been investigated, and a new interpretation of the eight-
mponent spinors as representing for example $(p-\Xi^-)$ or $(\Sigma^+-\Sigma^-)$
proposed. It enables one to relate the boson conjugation and the
inor conjugation proposed by Budini, Dallaporta and Fonda in an
ganic way with the single fundamental equation. The most
portant conservation laws of electric current and baryon number
e automatically guaranteed in the formalism, independently from
ch other.

530.145 : 539.12

ARCH FOR DIRAC MONOPOLES. See Abstr. 8441

530.145

24. QUANTAL DERIVATION OF MASS DEFECT. G.Araki.

clear Phys., Vol. 9, No. 4, 650-1 (Jan. (2), 1959).

A Hamiltonian for two interacting Dirac particles is reduced to
uli form. The mass defect is exhibited in the equation of motion.
R.J.N.Phillips

530.145 : 513.81

25. ELEMENTARY PARTICLES IN A FINITE WORLD EOMETRY. H.R.Coish.

ys. Rev., Vol. 114, No. 1, 383-8 (April 1, 1959).

To account for the elementary particles a new physical geo-
etry may be needed. A previous suggestion that this geometry may
finite is followed up by determining the representations of the
thogonal (Lorentz-like group). Because of the existence of a new
pe of orthogonality preserving transformation some of the repre-
ntations are multiple-valued. A change of value is identified with
gauge transformation and electric charge is recognized as a
rtain number determining the many-valuedness of the representa-
on. This charge number reverses sign under space inversion.
e charged pions and sigma particles are correlated with some
the new representations.

530.145

26. ON THE QUESTION OF A COVARIANT DEFINITION OF EUDOVECTOR SPIN.

A.Sokolov, I.M.Ternov and Yu.M.Loskutov.
. eksper. teor. Fiz., Vol. 36, No. 3, 930-2 (March, 1959).
Russian.

The components of the pseudovector spin operator are written
t and their transformation properties discussed. Comparison is
ade with the classical magnetic dipole operator. J.W.Gardner

530.145

27. ON THE THEORY OF A CLASS OF NON-SELF-ADJOINT PERATORS AND ITS APPLICATIONS TO QUANTUM SCATTER- G THEORY. C.L.Dolph and F.Penzlin.

n. Acad. Sci. Fennicae, A VI, No. 263, 36 pp. (1959).

The existing methods for treating problems which involve non-
lf-adjoint operators are discussed and a new approach is outlined.
ter a general development of the mathematical theory, the partic-
ar problems arising in quantum scattering and in the R-matrix of
igner are considered in detail. P.M.Davidson

530.145

28. MESON KINEMATICS IN STATIC SOURCE MESON HEORIES. F.R.Halpern.

n. Phys. (New York), Vol. 7, No. 2, 146-53 (June, 1959).

A method is given for constructing creation operators for many
eson states in static source meson theories. These states will be
agonal in the angular momentum, isotopic spin and they will form
e bases for irreducible representations of the permutation group.
e states for up to four mesons and for the angular momentum
d isotopic spin equal to either zero or one are explicitly given
the case of symmetric pseudoscalar meson theory.

530.145 : 539.12

29. THE PHYSICAL NUCLEON IN STATIC SOURCE MESON HEORY. F.R.Halpern, L.Sartori, K.Nishimura and R.Spitzer.

n. Phys. (New York), Vol. 7, No. 2, 154-73 (June, 1959).

A wave-function for the physical nucleon in static source meson theory has been constructed by the method of moments. The wave-function includes contributions from states containing as many as five mesons, and is shown to be a good approximation to the ground state of the Hamiltonian. Because of the restrictive nature of the static model, the probability that the meson cloud have a particular angular momentum or isotopic spin turns out to be almost independent of the dynamics of the system. Since the matrix elements of the nucleon spin and isotopic spin operators can be expressed in terms of these probabilities, such matrix elements are determined essentially by the kinematics of the meson cloud. This fact renders unreliable any predictions of the static model which depend on matrix elements of the nucleon operators. The consistent failure of the static model to explain satisfactorily the scalar part of the magnetic moment may be ascribed to this cause. The quantities which depend on meson operators are more closely related to the dynamics of the system. The vector part of the magnetic moment is in agreement with experiment, and the electron—neutron interaction turns out much too large; these results differ little from those obtained by the Chew—Low one-meson approximation. However, the contributions of the many meson states are not negligible, and the mean number of mesons is found to be closer to two than to one. Evaluation of the charge renormalization enables us to test the scattering amplitudes predicted by the static model against the sum rules of Cini and Fubini. It is found that, for the conventional value of renormalized coupling constant, the sum rules are strongly violated. This result, together with the substantial many meson component of the wave function, casts doubt on the validity of the one-meson approximation in the static model.

530.145 : 530.12

9230. NON-LOCAL INTERACTIONS AND THE SCATTERING MATRIX. J.Potter and K.Chadan.

C.R. Acad. Sci. (Paris), Vol. 248, No. 11, 1612-15 (March 16, 1959).
In French.

If a p—p interaction is the sum of a local interaction (including the Coulomb interaction) and a non-local but separable one, then a knowledge of the local part together with the scattering matrix at all energies determines the non-local part. J.C.Taylor

530.145

9231. AN APPROXIMATION METHOD FOR SOLVING SCATTERING PROBLEMS. A.Krzywicki.

Bull. Acad. Polon. Sci. Ser. Sci. math. astron. phys., Vol. 7, No. 1, 41-5 (1959).

The approximation consists in cutting off the expansion obtained by Glaser, Lehmann and Zimmermann (Abstr. 874 of 1958) for the Heisenberg operators into normal products of asymptotic in- or out-operators. W.A.Hepner

530.145

9232. ON THE EXISTENCE AND THE UNITARY PROPERTY OF THE SCATTERING OPERATOR. S.T.Kuroda.

Nuovo Cimento, Vol. 12, No. 5, 431-54 (June 1, 1959).

The mathematical character of scattering theory is investigated according to the "time dependent" formulation with special emphasis on the wave and the scattering operators. The main contents are: (1) some general properties of these operators are summarized; (2) the existence of the wave operator is proved under rather mild conditions on the potential; and (3) the existence and the unitary property of the scattering operator are proved under certain additional conditions. The arguments are mathematically rigorous.

530.145

9233. UNITARY PHASE SHIFT SCATTERING APPROXIMATION.

L.M.Garrido and P.Pascual.
Proc. Phys. Soc., Vol. 73, Pt 3, 528-30 (March, 1959).

It is shown that the n-th order Born approximation to the scattering phase-shifts can be improved by calculating the imaginary part of the scattering matrix directly from the unitarity property of the scattering matrix, with the real part given by the usual n-th order perturbation theory expression. This improvement holds provided the phase-shift is not near 45° or 135°. As an illustration the S phase-shifts for a square well potential of several depths are calculated by the usual first order Born approximation and by the modified method in the same order, and compared with the exact values. E.J.Squires

530.145

9234. THE ANALYTICAL NATURE OF THE NONRELATIVISTIC SCATTERING AMPLITUDE AND THE POTENTIAL.

Ya.A.Smorodinskii.
Zh. eksper. teor. Fiz., Vol. 34, No. 5, 1333-5 (May, 1958).
In Russian. English summary: PB 141052T-2, obtainable from

Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The S-wave scattering amplitude for the one-body Schrödinger equation with a central potential is considered. R.J.N.Phillips

530.145 : 539.12

CALCULATION OF n–p AND p–p SCATTERING FROM THE CASE–PAIS MODEL. See Abstr. 8456

530.145

9235. INVARIANT MATRIX POLYNOMIALS FOR TOTAL SPIN S = 1. Yu. I. Kulakov.
C.R. Acad. Bulg. Sci., Vol. 10, No. 4, 257-60 (July-Aug., 1957).
In Russian.

Simple forms of the polynomials are given and formulae derived which allow the decomposition of any rotation- and reflection-invariant operator in terms of these matrix-polynomials. An application of the method is given by applying it to the phase analysis of the scattering of two fermions in a triplet state. P.Roman

530.145

9236. APPLICATION OF THE V.RITZ METHOD IN THE QUANTUM THEORY OF FIELDS AND SOME GENERALIZATIONS OF THE TAMM–DANKOFF EQUATION. N.St.Kalitzin.
Izv. Bulg. Akad. Nauk, Vol. 6, 27-45 (1956; publ. 1957). In Bulgarian with summary (1 p.) in German.

It is shown by obtaining the system of the Tamm–Dankoff equations from a variational principle that the Ritz method can be used also in quantum field theory. After a simple generalization of the Tamm–Dankoff equations, the problems of the nucleon self-energy, the interaction of nucleons, and the scattering of mesons on a nucleon are investigated. P.Roman

530.145

9237. ON QUANTIZATION WITH AN INDEFINITE METRIC AND THE LEE MODEL. B.Ferretti.
Nuovo Cimento, Vol. 12, No. 5, 393-430 (June 1, 1959).

The Lee model is discussed in the case considered by Pauli and Källén, i.e. when the characteristic equation of the eigenvalues of the energy has only real and all differents roots. It is proved that introducing a suitable redefinition of the ingoing and outgoing states it is possible to construct an unitary S-matrix having reasonable physical properties. The suggested procedure is in some way similar to a renormalization which eliminates the ghost effects.

530.145

9238. ON THE ASYMPTOTIC AND CAUSALITY CONDITIONS IN QUANTUM FIELD THEORY. F.Kaschluhn.
Nuovo Cimento, Vol. 12, No. 6, 541-52 (June 16, 1959).

It is shown that the mathematical procedure of Lehmann, Symanzik and Zimmermann leads necessarily to a causal field theory in which the commutators of the field operators vanish for space-like distances. In order to study this fact from a more general point of view the authors use extensively variational derivatives of the S-matrix with respect to the free-field operators as proposed by Bogoljubov et al. The manner in which Lehmann, Symanzik and Zimmermann apply the asymptotic condition is investigated in more detail. Some general statements are made about the concept of causality in quantum field theory. It is indicated that only the causality condition in the form used by Bogoljubov et al. (and not the commutator condition) is sufficient for a general approach to quantum field theory as needed, for instance, in the theory of dispersion relations.

530.145 : 530.162

9239. ON THE EXISTENCE OF SOLUTIONS OF THE BRUECKNER EQUATIONS FOR A MANY-FERMION SYSTEM. V.J.Emery.
Nuclear Phys., Vol. 12, No. 1, 69-83 (June (3), 1959).

The Brueckner reaction matrix for a many-fermion system is frequently introduced as the formal "sum" of an infinite series which is a part of the complete many-body perturbation series. It is shown that, when the system is infinite, for any "well-behaved" potential, there are always some unperturbed states for which the reaction matrix series diverges. Conditions for the existence of solutions of the integral equations for the reaction matrix are discussed and it is shown that "Cooper-type" singularities arise for potentials v(r) with not too strongly bound states provided $\int_0^\infty v(r) \sin^2 k_F r dr$ is not positive ($\hbar k_F$ being the Fermi momentum). Explicit calculations show that there are other types of reaction matrix singularities for nuclear matter but not for liquid helium three. The results provide a potential foundation for Belyaev's calculations of nuclear spectra and suggest that there should be no energy gap in the spectrum of liquid helium three.

530.145

9240. ON THE RELATION OF THE WAVE MECHANICAL EIGENVALUE PROBLEM TO CLASSICAL MECHANICS. I.Fényes.
Acta. phys. Hungar., Vol. 9, No. 3, 245-59 (1959). In German.

It is usual to effect the transition from wave mechanics to classical mechanics by proceeding to the limit as h → 0. However the wave mechanical eigenvalue problem has, in general, no classical counterpart. In clarifying the relation between the two theories approximate solutions such as those of the Bohr theory, the W.K.B. method and the statistical atom model, play an important part. T.R.Carson

530.145

9241. THE HYPOTHESIS OF IRREGULAR FLUCTUATION AND THE CAUSAL INTERPRETATION OF THE WAVE MECHANICS OF SYSTEMS. J.Andrade e Silva.
C.R. Acad. Sci. (Paris), Vol. 248, No. 12, 1785-7 (March 23, 1959).
In French.

It is shown that the hypothesis of irregular fluctuations, proposed by Bohm and Vigier for the case of a single particle, has to be generalized before it can be applied to a system of particles. J.K.Skwirzynski

530.145

9242. A GENERALIZATION OF THE HYPOTHESIS OF IRREGULAR FLUCTUATIONS FOR CAUSAL INTERPRETATION OF THE WAVE MECHANICS OF SYSTEMS. J.Andrade e Silva.
C.R. Acad. Sci. (Paris), Vol. 248, No. 13, 1947-9 (April 1, 1959).
In French.

A generalization of the hypothesis of irregular fluctuations of Bohm–Vigier is proposed; the author shows here that it is suitable for a representation of systems of particles in a physical space discussed in the preceding abstract. J.K.Skwirzynski

530.145

9243. ON A VARIATIONAL PRINCIPLE FOR THE MANY-BODY PROBLEM. N.N.Bogolyubov and V.G.Solov'ev.
Dokl. Akad. Nauk SSSR, Vol. 124, No. 5, 1011-14 (Feb. 11, 1959).
In Russian.

A recently proposed generalization of Fock's variational principle (Abstr. 3719 of 1958) is examined further and applied to two special cases of interest. P.K.Kabir

530.145

9244. CERTAIN ALGORITHM IN QUANTUM MECHANICS. I.S.Arzhanўkh.
Dokl. Akad. Nauk SSSR, Vol. 126, No. 1, 45-8 (May 1, 1959).
In Russian.

The algorithm provides a universal operator which, in particular, can be realized as the operator in Schrödinger's equation or as the Hamiltonian H in Hamilton–Jacobi equations; the constructio of such an operator constitutes the dialectical synthesis of the connection between the classical and the quantum mechanics. The author exemplifies use of this operator for deriving Schrödinger's and the relativistic equation of quantum mechanics for a single particle and for a system of interacting particles. J.K.Skwirzynski

530.145

9245. CLUSTER DEVELOPMENTS FOR JASTROW WAVE FUNCTIONS. II. INTRODUCTION OF IRREDUCIBLE CLUSTER FUNCTIONS. C.D.Hartogh and H.A.Tolhoek.
Physica, Vol. 24, No. 11, 875-95 (Nov., 1958).

For Pt I, see Abstr. 62 (1959). A reduction is carried out by means of the introduction of irreducible cluster functions and the use of certain combinatorial methods. The reduction results in a development of $g_k(r^k)$, in which the $b_{k,l}(r^k)$ are replaced by simpler terms, which are sums of cluster integrals involving irreducible cluster functions only. The presentation includes a generalization to mixtures of fermions of different types.

530.145

9246. CLUSTER DEVELOPMENTS FOR JASTROW WAVE FUNCTIONS. III. EXPRESSIONS FOR THE DISTRIBUTION FUNCTIONS AND THE ENERGY; APPLICATION TO NUCLEAR MATTER; EXPANSIONS AT LOW TEMPERATURE.
C.D.Hartogh and H.A.Tolhoek.
Physica, Vol. 24, No. 11, 896-909 (Nov., 1958).

The cluster developments formulated in Parts I and II are extended to particles with spin. Explicit results are given for the distribution functions and the energy, including the case of fermion mixtures. A discussion is given of the application of the method to uclear matter. Splitting into a "statistical" part and a "dyna- ical" part can also be made for a Bose or Fermi gas at low temper- ture. It leads to the introduction of more detailed cluster integrals. the fugacity expansion of the pressure and the density, they can e rearranged, roughly to increasing powers of (δ/λ) (δ, range of he forces; λ, the De Broglie wavelength).

530.145

247. SOME CHARACTERISTIC SYMMETRIES OF THE EIGEN- UNCTIONS OF THE SCHRÖDINGER EQUATION.
.A.Bochvar, N.P.Gambaryan, I.V.Stankevich and A.L.Chistyakov.
h. eksper. teor. Fiz., Vol. 36, No. 2, 626-7 (Feb., 1959). In Russian.

It is pointed out that the group of symmetries of the eigenfunc- ions forms a sub-group of the group of symmetries G_H of the corre- ponding Hamiltonian, and therefore there exists at least another ub-group of G_H which does not appear as a symmetry-group of the igenfunctions of the Schrödinger equation. P.K.Kabir

STATISTICAL MECHANICS

TRANSFER PROCESSES

530.162

248. ON THE APPLICATION OF THE METHOD OF SUPPLE- MENTARY VARIABLES TO STATISTICAL PHYSICS.
.Pavlikovskii and V.Shchuruvna.
Dokl. Akad. Nauk SSSR, Vol. 124, No. 1, 69-71 (1959). In Russian.

The Bohm—Pines method is applied to the calculation of the artition function of a system of interacting fermions. The calcu- ation is performed both for the ordinary Bohm—Pines supplement- ry conditions $Q_k\Psi = 0$ and for modified supplementary conditions f the form

$$(\gamma_k^2 Q_k + iP_k)\Psi = 0,$$

here γ_k is a specified function of the wave-number k. It is shown hat only the modified supplementary conditions yield a partition unction behaving properly in the classical limit. O.Penrose

530.162

249. A NEW METHOD IN THE CLASSICAL STATISTICAL ECHANICS. A.A.Vedenov.
okl. Akad. Nauk SSSR, Vol. 125, No. 4, 757-60 (April 1, 1959).
n Russian.

A new method is proposed for evaluating thermodynamical poten- ials of a system of interacting particles on the basis of Boltzmann's tatistical mechanics. It depends on the calculation of change of free nergy (due to interactions) by means of an even correlation function. his correlation function is expanded as a series of products of nteraction potentials; the formulation of these products is facilitated y constructing special topological graphs. As examples of the ethod, calculations are shown of the second virial coefficient for a as of particles with short- and long-range forces. A second-order orrection is given for the correlation function of the free energy f such a gas. J.K.Skwirzynski

530.162

250 TEMPERATURE VARIATION OF MAYER'S CLUSTER NTEGRALS. T.Kihara and S.Kaneko.
. Phys. Soc. Japan, Vol. 12, No. 9, 994-6 (Sept., 1957).

By use of the square-well model of intermolecular potential, he temperature variation of Mayer's cluster integrals, b_l for = 2, 3, ..., has been investigated (except the region of very high emperature where a soft repulsive potential must be taken into ccount). The b_2 is monotone; b_3 has a minimum near the Boyle emperature T_B; b_4 has a minimum below T_B and a maximum above B; b_5 has a sharp minimum below T_B, a maximum near T_B, and a inimum above T_B; and so forth. Curves are shown up to b_6.

530.162

251. REMARKS ON THE GIBBS PARADOX. M.J.Klein.
ed. Tijdschr. Natuurkde, Vol. 25, No. 3, 73-6 (March, 1959).

By consideration of the entropy of mixing of a gas with more of he same gas in an excited metastable state, it is shown that the ntropy of mixing of two gases disappears continuously, not "suddenly" s Gibbs concluded, as the two gases become identical.
J.Hawgood

530.162

9252. COLLECTIVE PHENOMENA IN SCIENCE. D.ter Haar.
Ned. Tijdschr. Natuurkde., Vol. 25, No. 4, 89-105 (April, 1959).
In Dutch.

A review of collective motions in general, plasma oscillations in metals, applications to liquid helium and superconductors, and collective phenomena in nuclei. E.P.Wohlfarth

530.162

9253. ERGODIC FOUNDATION OF QUANTUM STATISTICAL MECHANICS. P.Bocchieri and A.Loinger.
Phys. Rev., Vol. 114, No. 4, 948-51 (May 15, 1959).

Relations, which are ergodic in a generalized sense, are deduced from the laws of quantum theory without any hypothesis of a priori probabilities. These relations are satisfied for the overwhelming majority of the initial state-vectors of any isolated system with very many degrees of freedom. By means of these relations, it is proved that a system — when weakly coupled with another system having a comparatively very large number of degrees of freedom — does not deviate significantly from the canonical distribution at the overwhelming majority of the time instants.

530.162

9254. ON THE APPROACH TO EQUILIBRIUM OF A QUANTUM GAS. I.Prigogine and P.Résibois.
Physica, Vol. 24, No. 10, 796-816 (Oct., 1958).

The density of the gas is assumed low enough to make the ideal B.E. or F.D. gas model adequate to describe the equilibrium properties. The particles interact by arbitrary central forces (e.g. hard spheres). A diagram technique is used to derive a "master equation", in which the transition probabilities are complicated functions of the occupation numbers. An expansion of these transition probabilities in powers of the occupation numbers yields a kinetic equation similar to the Uehling—Uhlenbeck equation, but containing extra terms describing the effect of the B.E. or F.D. statistics on the intermediate states in a binary collision. O.Penrose

530.162

9255. ON THE THEORY OF A NON-IDEAL BOSE GAS.
Yu.V.Sanochkin.
Dokl. Akad. Nauk SSSR, Vol. 125, No. 2, 308-10 (1959). In Russian.

By taking into account also those terms of the Hamiltonian which were previously omitted by Bogolyubov [Izvestiya Akademii Nauk SSSR, Seriya fizicheskaya, 11, 67 (1947)], the energy of the ground state and the one-boson excitation-spectra are calculated. By partial summing over the relevant graphs a model-Hamiltonian is obtained. This is discussed in detail. P.Roman

530.162

9256. ENERGY SPECTRUM OF A BOSE GAS.
V.M.Eleonskii and P.S.Zyryanov.
Zh. eksper. teor. Fiz., Vol. 34, No. 3, 770-1 (March, 1959).
In Russian. English translation in: Soviet Physics — JETP (New York), Vol. 34(7), No. 3, 530-1 (Sept., 1958).

This is studied by expanding the interaction kernel in a series of moments rather than a Fourier series; standard results are recovered. A better approximation to experiment is found by including weak attractive forces as well as hard-sphere repulsion in the kernel.
R.J.N.Phillips

530.162

9257 POINCARÉ RECURRENCE TIMES. J.A.McLennan,Jr.
Phys. of Fluids, Vol. 2, No. 1, 92-3 (Jan.-Feb., 1959).

It is shown that the average time between consecutive returns of a phase point to a macro-cell of phase space is $t_i = \theta_i \exp[(S-S_i)/k]$. Here S_i is the entropy of the system if its phase point is known to be in the i-th macrocell, S is the entropy if the system is merely known to be in the corresponding energy shell, and θ_i is the average time spent by the phase point in the i-th cell per recurrence. A numerical estimate is given. P.T.Landsberg

530.162 : 536.7

STATISTICAL MECHANICS OF SOLID AND LIQUID MIXTURES OF ORTHO- AND PARA-HYDROGEN. See Abstr. 8060

530.162 : 539.19

EQUILIBRIUM STATISTICAL MECHANICS OF DISSOCIATING DIATOMIC GASES. See Abstr. 8696

530.162 : 530.145

SOLUTIONS OF THE BRUECKNER EQUATIONS FOR A MANY-FERMION SYSTEM. See Abstr. 9239

GENERAL MECHANICS

MECHANICS OF SOLIDS

531.25 : 535.55

9258. ON THE ELIMINATION OF SECONDARY TENSIONS PRODUCED BY LARGE DEFORMATIONS IN THREE-DIMENSIONAL PHOTOELASTICITY. W.Schumann.

C.R. Acad. Sci. (Paris), Vol. 248, No. 1, 65-7 (Jan. 5, 1959). In French.

To obtain a measurable optical effect with the resins used in three-dimensional work large deformations, which give rise to parasitic stresses, are required. The theory of a method of eliminating these stresses is given and it is claimed that experiments have confirmed its applicability. H.G.Jerrard

531.25 : 535.33

9259. DISPERSION OF THE STRESS OPTIC COEFFICIENT OF THE ALKALI HALIDES. R.Srinivasan.

Z. Phys., Vol. 155, No. 3, 281-9 (1959).

The dispersion of

$$C = \frac{n^3}{2}(q_{11} - q_{12})$$

has been measured for NaCl, KCl, KBr and KI, from the visible to the ultraviolet region. In general, C decreases with wavelength for all crystals. While the dispersion is only a few per cent in the visible region, it is enormous in the ultraviolet. NaCl shows a dispersion of about 100% from 5800 to 2400 A; KCl about 200% from 5000 to 2400 A; KBr about 300% from 5000 to 2400 A; and KI about 400% from 5000 to 2800 A. Also the potassium halides exhibit a change in sign of C in the ultraviolet. In KCl the sign reversal occurs at about 2550 A; in KBr, at 2760 A; and in KI, at 3380 A. Below these wavelengths, the potassium halides belong to the same class in Mueller's classification as sodium chloride. The theory of Ramaseshan and Sivaramakrishnan based on the assumption that a stress causes a change in the frequencies and oscillator strengths of atoms does not explain the observed behaviour of the alkali halides. Moreover, the mere variation of the ionic refractivities with wavelength also does not explain the observed dispersion on Mueller's theory. One is forced to assume that the strain polarizability constant K in Mueller's theory varies with wavelength. When K is calculated from the experimentally observed values of C, it is found to increase with decreasing wavelength for all alkali halides. The variation with wavelength of K for all the alkali halides can be fitted well by a formula of the type given by Ramaseshan and Sivaramakrishnan. Hence it appears that the total dispersion of C can be explained only when we take into account the variation with wavelength of (1) the Lorentz and Coulomb contributions from Mueller's theory, and (2) the strain polarizability constant from Ramaseshan and Sivaramakrishnan's theory.

531.252

9260. STRESSES AND DEFORMATIONS OF A DISK SUSPENDED VERTICALLY ON A FLEXIBLE BAND. E.E.Daniushevskii.

Astron. Zh., Vol. 2, No. 2, 277-82 (1958). In Russian. English translation in: Soviet Astron. — AJ (New York), Vol. 2, No. 2, 251-5 251-5 (March-April, 1958).

By a general algebraic solution of the problem in the theory of elasticity the stresses, deformations and displacements in a plane disk, caused by the vertical component of forces of reaction, were calculated in an ideal case, when the disk is suspended on a flexible band, surrounding one half of its circumference, and only normally directed forces of reaction, without friction, act upon it. It is shown that the displacements of the surface of a plane glass disk arising from such forces, even if it is in a vertical position, do not appreciably affect the form of the surface up to certain dimensions of the disk, i.e. up to 3 m diameter and thickness 50 cm. Therefore the resulting wave aberration of a plane lightwave after its reflection by the plane surface of the disk, used as a mirror, does not exceed Rayleigh's limit for an ideal image. Disks larger than this limit are visibly deformed and the more so, the larger their volume. The image given after reflection by the plane surface of such disks ceases to be ideal.

531.258

9261. THE TRANSVERSE FLEXURE OF UNIFORMLY LOADED AND FULLY RESTRAINED THIN ISOTROPIC PLATES WITH CURVILINEAR EDGES. W.A.Bassali.

J. Mech. Phys. Solids, Vol. 7, No. 3, 145-56 (June, 1959).

Deals with the application of complex variable analysis to establish exact solutions in finite terms for the complex potentials and small transverse deflections of certain thin clamped elastic plates subject to uniform loading distributed over the entire plate. The isotropic plates considered are bounded by certain regular curvilinear polygons which include as special cases the inverse of an ellipse with respect to its centre as well as plates bounded by approximately circular arcs. Explicit formulae for the moments and shears are given at the centres of the plates and at the midpoints of their curvilinear edges. The usual assumptions relating to the classical theory of thin plates are adopted.

531.259.1

9262. BENDING, BUCKLING AND OSCILLATION OF A MULTI-SPAN STRAIGHT BEAM. S.Falk.

Abhandl. Braunschw. Wiss. Gesell., Vol. 7, 74-92 (1955). In German

The problem is systematically formulated using matrices, and is solved in the case of constant section-coefficients.

531.259.2

9263. DYNAMICAL PROBLEM FOR A CONICAL SHELL. I.S.Gerasimov.

Dokl. Akad. Nauk SSSR, Vol. 125, No. 5, 989-91 (April 11, 1959). In Russian.

An elastic, circular, conical shell is subjected to a load (constant pressure, axially symmetric and normal to the surface of the cone), extending itself with a constant velocity from the apex, down the axis of symmetry. The thickness of the surface of the cone is a linear function of the distance from its apex. The differential equations of the surface displacements are set up and boundary conditions are discussed. J.K.Skwirzynski

531.259.22

9264. ON TORSION OF THIN CYLINDRICAL SHELLS. E.Reissner.

J. Mech. Phys. Solids, Vol. 7, No. 3, 157-62 (June, 1959).

Considers an application of the theory of elastic, thin cylindrical shells to the problem of St.Venant torsion. Simple explicit general results are obtained for non-homogeneous shells, which include as special case Bredt's formulae for closed tubes and known results for tubes slit along a generator. It is also found that the problem of St. Venant torsion requires use of a formulation of shell theory which is more accurate than Love's first approximation theory.

531.259.22

9265. THE LOAD CARRYING CAPACITIES OF CYLINDRICAL SHELLS SUBJECTED TO AIRING OF FORCE. G.Eason.

J. Mech. Phys. Solids, Vol. 7, No. 3, 169-81 (June, 1959).

Stress fields and associated velocity fields are obtained under conditions of axial symmetry, for circular cylindrical shells of rigid—plastic material satisfying the Tresca yield condition. The particular problem of a shell of any length subjected to a ring of force is considered in detail.

531.36

9266. THE DIFFERENTIAL EQUATIONS OF TRANSLATIONAL—ROTATIONAL MOTION OF MUTUALLY ATTRACTING RIGID BODIES. G.N.Duboshin.

Astron. Zh., Vol. 35, No. 2, 265-76 (1958). In Russian. English translation in: Soviet Astron. — AJ (New York), Vol. 2, No. 2, 239-50 (March-April, 1958).

The general problem of the translational—rotational motion of a system of absolutely rigid bodies is considered, the elementary particles of which are mutually attracted according to Newton's Law. The differential equations of motion in an absolute system of coordinates are formed, and it is shown that these equations have the same ten classical integrals as the equations of absolute motion of a system of material points. The problem of separating the general equations into equations of translational motion of the mass centres and equations of rotationsl motion of the bodies about the mass centres is investigated. It is established that the equations separate strictly into two independent systems only when each body of the system is a sphere possessing a spherical density distribution In all other cases such a separation of the equations is possible only after certain approximations. In particular if only terms containing second and third powers of inverse distance remain in the differentia equations, then the equations of translational motion are separated, forming an independent system, and the equations of rotational motion contain the coordinates of the mass centres, which can be regarded as known functions of the time. Finally, some transformations of the absolute equations of motion to moving axes are considered having either translational motion only or possessing both translational and rotational motion.

531.36 : 539.215.9

267. AXIALLY SYMMETRIC MOTION IN SAND-LIKE SUBTANCES. S.S.Grigoryan.
Priklad. Mat. i Mekh., Vol. 21, No. 2, 221-30 (1957). In Russian.

Ishlinskiĭ [Ukrainskiĭ Matemat. Zhurnal, Vol. 6, No. 4, (1954)] onstructed equations, describing plane motion in a sand-like nedium; his most important hypothesis, underlying these equations, s that the motion in such medium takes place immediately on the pplication of stress conditions which are assumed to continue during ubsequent motion. Following him, the author constructs corresponding equations for an axially symmetrical motion assuming also imiting and static stress conditions. Simple cases of cylindrical nd spherical symmetry are studied in detail.

J.K.Skwirzynski

531.381

268. A PARTICULAR INTEGRABLE CASE OF THE EULER—POISSON EQUATION. E.I.Kharlamova.
Dokl. Akad. Nauk SSSR, Vol. 125, No. 5, 996-7 (April 11, 1959). n Russian.

Motion of a heavy solid body round a stationary point, when this ody contains cavities filled with an ideal, incompressible liquid, an be determined when the quadratic coefficients of velocities in he kinetic energy expression are found. The case of ellipsoidal avities is considered and these coefficients are determined imlicitly in terms of solution of a first order differential equation.

J.K.Skwirzynski

531.383

269. SYNTHESIS OF INVARIANT, DAMPED, INERTIAL SYSEMS WITH AN ARBITRARY PERIOD.
V.A.Bodner, V.E.Ovcharov and V.P.Seleznev.
Dokl. Akad. Nauk SSSR, Vol. 125, No. 5, 986-8 (April 11, 1959). n Russian.

Inertial systems based on the use of a gyroscopic model of chiller's pendulum have several disadvantages which can however e overcome by methods suggested by Luzin and Kulebakin [Dokl. kad. Nauk SSSR, Vol. 51, No. 4 and 5 (1946); Vol. 80, No. 3, (1951)]. The authors describe the adjustment of the synthesis (by means of yroscopic platforms) of such damped, inertial systems with an arbirary period, which is kept constant, independently of external imulses. It is concluded that a complete adjustment is possible by neans of external information, applied discretely or continuously

J.K.Skwirzynski

531.53

270. PERIODIC SOLUTIONS OF THE SECOND KIND OF THE GENERALIZED PENDULUM EQUATION. G.Sansone.
Mem. Accad. Naz. Lincei, Vol. 5, No. 4, 59-79 (1959). In Italian.

The equation $\frac{d^2\Theta}{dt^2} + f(\Theta,\alpha)\frac{d\Theta}{dt} = g(\Theta)$, of which the corresponding haracteristic equation is $\frac{dz}{d\Theta} = g(\Theta)/z - f(\Theta,\alpha)$, is considered. It is hown that there is a critical value α_0 - zero, positive or infinite - nd that there is an existence theorem for α_0 positive or zero. For $\alpha_0 > 0$, and $\alpha < \alpha_0$ ($\alpha > \alpha_0$) the characteristic equation leads (does ot lead) to a periodic solution (of the second kind) with period 2π.

S.Weintroub

531.532

271. A REDUCED SOLUTION FOR THE SIMPLE PENDULUM: NEW APPROACH TO ELLIPTIC FUNCTIONS. L.Gold.
. Franklin Inst., Vol. 267, No. 6, 503-9 (June, 1959).

A powerful method for characterizing elliptic functions is resented. In particular, elliptic functions of the first kind are exressible in terms of a fractional power series

$$\sum_{n=0}^{\infty} a_{n+1}\phi^{n+1/2},$$

where ϕ is an angular displacement variable and the a_i coefficients erive from an appropriate inverse differential equation for the endulum motion. The correspondence between such a power series nd the conventional elliptic integrals is pointed out.

531.573

272. INTERNAL BALLISTICS OF A GUN AFTER ALL BURNT.
M.S.Sodha.
. appl. Phys., Vol. 30, No. 3, 441 (March, 1959).

The basic equations are modified to allow for non-adiabatic xpansion (due to friction and heat transfer to the barrel) of proellant gases after all burnt.

J.K.Skwirzynski

531.578

9273. ON PHYSICS OF ARMOUR PENETRATION.
M.S.Sodha and V.K.Jain.
J. appl. Phys., Vol. 29, No. 12, 1769-70 (Dec., 1958).

The energy equation of the penetration of a thin plate by a projectile, derived by Thomson (Abstr. 2254 of 1955) is used to obtain the kinetic energy and hence, in the limit, the total work done, for conical and ogival projectiles. A mistake in Thomson's calculation is corrected.

J.K.Skwirzynski

MECHANICAL MEASUREMENTS

531.715 : 535.417

MEASUREMENT OF THE THICKNESS OF VERY FINE TRANSPARENT FILMS BY THE INTERFERENCE METHOD. See Abstr. 7999

531.753

9274. USE OF QUARTZ VIBRATOR FOR WEIGHING THIN LAYERS AND AS A MICRO-BALANCE. G.Sauerbrey.
Z. Phys., Vol. 155, No. 2, 206-22 (1959). In German.

The deposition of a thin layer of material on a quartz vibrator alters its natural frequency; the change in frequency can be measured very accurately and this provides the basis of a method for obtaining the weight or thickness of the layer. The practical applications of this method are explored. Temperature fluctuations limit the accuracy, a change of 1°C resulting in a change of $\pm 4 \times 10^{-9}$ g/cm^2, corresponding to an average thickness of 0.4 A for a density of 1 g/cm^3. The method can be applied to the direct measurement of a small mass and an accuracy of 10^{-10} g can be attained.

H.J.H.Starks

531.753

9275. A NEW METHOD FOR THE COMPARISON OF MASSES IN VACUO. C. de Vreese.
Z. InstrumKde, Vol. 67, No. 2, 25-8 (Feb., 1959). In German.

The separate buoyancy corrections required when comparing two masses of different volumes are eliminated. Each mass in turn is enclosed in the same glass bell-jar which is then evacuated. The mass of the jar + contents is then obtained by substitution weighing. Details are given of the apparatus and calculations involved, together with a practical application.

S.Weintroub

531.79 : 621.317.39

9276. USE OF CAPACITY-CONTROLLED R.F. ENERGIZED IONIZATION TRANSDUCER FOR BALANCING ROTORS.
W.A.Gross.
Rev. sci. Instrum., Vol. 30, No. 7, 522-4 (July, 1959).

A rotor-balancing technique is described in which conventional laboratory equipment may be used. The orbiting motion of a rotating shaft within its own fixed bearings is detected by capacitator probes. After passing through the transducer circuit, the signal is displayed on an oscilloscope. It is therefore possible to obtain the necessary balancing information at operating conditions.

MECHANICS OF FLUIDS

532.13 : 539.19

9277. RHEOLOGY OF MACROMOLECULAR SYSTEMS.
J.D.Ferry.
Rev. mod. Phys., Vol. 31, No. 1, 130-5 (Jan., 1959).

Elastic energy can be stored in a macromolecular system without cross-links when it is subjected to steady-state flow. Examples are given to illustrate how, from experimental measurements of stored energy and from equivalent information about response to oscillating stresses, conclusions can be drawn regarding the ease of motion of macromolecular segments through their surroundings and regarding the nature of long-range coupling between molecules. The experiments involve the measurement of (a) steady-flow viscosity, (b) steady-state compliance, (c) various parameters representing characteristic times, for solutions of macromolecules.

J.Iball

532.133

9278. ON THE ANALYTICAL REPRESENTATION OF TEMPERATURE AND PRESSURE DEPENDENCE OF THE VISCOSITY OF GASES, VAPOURS, AND LIQUIDS.

J.Brabic.
Czech. J. Phys., Vol. 8, No. 4, 450-6 (1958). In German.

The law of corresponding states has been applied to the viscosity isobars and isotherms with extrapolations to zero pressure and temperature so that $\eta_0 \neq 0$. The viscosity isotherms are then analogous in shape to van der Waals' isotherms. R.Schnurmann

532.133

9279. CHAIN ENTANGLEMENT AND NON-NEWTONIAN FLOW.

E.B.Bagley and D.C.West.
J. appl. Phys., Vol. 29, No. 10, 1511-12 (Oct., 1958).

Log—log plots of viscosity against molecular weight of poly-(dimethyl siloxane) fluids each consist of two straight lines. As molecular weight increases through a value M_c the slope changes from about 1.4 to a greater value S. With increasing rate of shear (from 16 to 10^4 sec^{-1}), M_c decreases from 3.8×10^4 to 2.8×10^4 (at 67 sec^{-1}) and thereafter remains constant, while S decreases steadily from 4.1 to < 2. Interpreting M_c as a measure of polymer chain length at which molecular entanglements occur, it is deduced that non-Newtonian flow occurs as a consequence of molecular entanglements, the effect of entanglements decreasing with increasing shear rate. J.G.Oldroyd

532.133

9280. NON-NEWTONIAN VISCOSITY OF SYNTHETIC RUBBER AND ITS SOLUTIONS.

F.Bueche.
J. appl. Phys., Vol. 30, No. 7, 1114 (July, 1959).

A similar variation of viscosity with rate of shear has been found for rubber and its solutions as had been observed previously for polystyrene and polymethylmethacrylate. Over a concentration range 13-50 per cent rubber (GRS-1006) in diethyl benzene a cone viscometer has been used and for concentrations 50-100 per cent rubber a concentric cylinder rotational instrument. The average molecular weight of the rubber was of the order of 200 000.
R.Schnurmann

532.133

9281. VISCOSITY-TEMPERATURE RELATIONSHIPS FOR DILUTE SOLUTIONS OF CELLULOSE DERIVATIVES.

II. INTRINSIC VISCOSITIES OF ETHYL CELLULOSE.

W.R.Moore and A.M.Brown.
J. Colloid Sci., Vol. 14, No. 3, 343-53 (June, 1959).

For Pt I, see Abstr. 4334 (1959). Temperature variations of intrinsic viscosities and some other viscosity parameters for ethyl cellulose fractions in representative solvents are considered in terms of some current hydrodynamic and thermodynamic treatments of the viscosities of dilute polymer solutions. The value of $[\eta]$ decreases strongly with increasing temperature, the dependence being approximately linear. The temperature coefficient of $[\eta]$ appears to be linearly related to the molecular weight of the polymer. Except in the case of chloroform, in which aggregation of polymer may occur, values of the exponent a in the expression $[\eta] = KM^a$ decrease slightly with increase of temperature suggesting decreasing chain extension. Values of the Porod—Kratky persistence length q, the Kirkwood—Riseman effective bond length b, and the angle between successive bond planes in the polymer chains suggest decreasing chain stiffness as the temperature increases. The Flory treatment is applied to obtain qualitative information regarding the contributions of different factors to the negative temperature coefficients of $[\eta]$, suggesting that these are primarily due to decreases in the value of $(\bar{r}_0^2 M)$, where $\bar{r}_0^2$ is the mean-square unperturbed end-to-end distance of the chains and M the molecular weight. The variations of $[\eta]$ and its temperature coefficient with solvent are briefly discussed.

532.137

9282. MEASUREMENT OF ABSOLUTE VISCOSITIES OF LIQUIDS AND THE INFLUENCE OF SURFACE TENSION.

P.Rajgopala Rao and N.Subramanian.
J. sci. industr. Res., Vol. 18B, No. 4, 170-1 (April, 1959).

A method of correcting readings of an Ostwald viscometer for surface tension effects is suggested, based on dimensional analysis.
J.G.Oldroyd

532.14 : 536.423

9283. THE TEMPERATURE VARIATION OF ORTHOBARIC DENSITY DIFFERENCE IN LIQUID—VAPOUR SYSTEMS.

V. AMINES.

J.M.Costello and S.T.Bowden.
Recueil Trav. chim. Pay-Bas, Vol. 78, No. 5, 391-403 (May, 1959).

The densities of a series of aliphatic amines, together with one of aniline and its methyl derivatives, were measured over ranges of temperature below and above the normal boiling point. The variation of orthobaric density difference may be represented by equations of the Verschaffelt type using estimated values of the critical temperature. On this basis it is found that the exponent for the lower members is slightly higher than that for non-associated liquids and that its value decreases with increasing complexity of the amine. In general, the exponent for secondary amines is lower than that for primary amines, and the still lower values for tertiary amines is to be ascribed to causes other than hydrogen bonding. The behaviour of aniline and its N-methyl derivatives is well represented by the Verschaffelt equation over a range of 300°. It is shown that the Lewis equation relating to zero and critical densities is obeyed closely by associated substances.

532.14

9284. TECHNIQUE FOR MEASUREMENT OF SPECIFIC VOLUME OF LIQUIDS AT HIGH PRESSURES AND TEMPERATURES.

R.M.Cornish and I.Simon.
Rev. sci. Instrum., Vol. 30, No. 7, 565-7 (July, 1959).

A novel method is described for measuring specific volume of liquids at high temperatures and pressures. The displacement of the two ends of a continuous column of the liquid is measured. One end is maintained at high temperature and pressure while the other is at normal conditions.

532.5 : 538.3

EFFECTS OF GRAVITATIONAL FIELDS ON FLUID MOTION.

See Abstr. 8388

532.5 : 530.1

QUADRATIC LAGRANGIANS IN RELATIVISTIC HYDRODYNAMI

See Abstr.

532.517

9285. A BOUNDARY CONDITION PROBLEM FOR LINEARIZED EQUATIONS OF HYDRODYNAMICS OF VISCOUS LIQUIDS.

S.S.Litvinkov.
Dokl. Akad. Nauk SSSR, Vol. 125, No. 5, 998-1001 (April 11, 1959).
In Russian.

A smooth surface S is immersed in a moving viscous liquid of infinite extent. Author shows that the components of velocity vector can be expanded in terms of spherical harmonics; then, usual boundary conditions (given velocity on the surface S and Cauchy conditions at infinity) lead to a unique solution, which can be formulated in terms of special second order tensors. The components of these tensors can, for $k = 0$ (where $k^2 = \alpha/\nu$, while α is the time constant of the velocity decay and ν is the coefficient of kinematic viscosity), be expressed by means of Odquist's potentials.
J.K.Skwirzynski

532.517

9286. POWER LAW FLOW CURVES OF DIMETHYL SILOXANE POLYMERS.

E.B.Bagley.
J. appl. Phys., Vol. 30, No. 4, 597 (April, 1959).

In the equation $\log \eta = A + S \log M$, where η is the viscosity, M the molecular weight, and S the slope, it is shown empirically that for values of M greater than that at which chain entanglement is postulated, and over the shear rate range 100 to 3000 reciprocal seconds, $S = 4.63 - 0.668 \log G$, where G is the shear rate. From these two equations a power law relationship between shear rate and shear stress is derived, which, although not a true rheological equation, is shown graphically to hold good over the shear rate range concerned for various poly-(dimethyl siloxane) fluids.
B.J.Wilson

532.517

9287. MICROSCOPIC EDDYING NEAR A VIBRATING ULTRASONIC TOOL TIP.

F.J.Jackson and W.L.Nyborg.
J. appl. Phys., Vol. 30, No. 6, 949-50 (June, 1959).

Circulations were studied using illuminated polystyrene spheres suspended in a degassed glycerine—water mixture. Two distinct pairs of eddies were observed near the periphery of the tool tip; the first set adjacent to the tip were always present; the second set were only present when the tip was near a plane solid surface. The speed and shape of the latter circulations were a function of the spacing between the tip and the plane.
H.D.Parbrook

532.517.3

9288. TRANSITION OF TURBULENT BOUNDARY LAYER TO A LAMINAR ONE.

A.A.Sergienko and V.K.Gretsov.
Dokl. Akad. Nauk. SSSR, Vol. 125, No. 4, 746-7 (April 1, 1959).
In Russian.

Air flowing through a tube at a speed of 45 m/sec enters into a zzle where it is accelerated to 560 m/sec. Results of measure- ents are shown in a diagram where velocities in the boundary layer e plotted against the distance from the wall. From these results is inferred that the boundary layer is turbulent at the inlet to the zzle whereas it is sometimes turbulent, sometimes laminar, at outlet of the nozzle. Hence a transition from turbulent to ninar flow in the boundary layer takes place during the flow rough the nozzle. R.Eisenschitz

532.525 : 537.29

89. ON THE THEORY OF THE STABILITY OF LIQUIDS JETS AN ELECTRIC FIELD. G.A.Glonti.

. eksper. teor. Fiz., Vol. 34, No. 5, 1329-30 (May, 1958). Russian. English summary: PB 141052T-2, obtainable from fice of Technical Services, U.S. Dept. of Commerce, Washington, C., U.S.A.

The electrostatic field equation is combined with the general drodynamic equation for a viscous fluid, as is done in magneto- drodynamics, to study the criteria for stability of a cylindrical of liquid dielectric in an electrostatic field. The effects of scosity and direction of the field are examined as well as that of radius. Conditions for equilibrium at the surface are given. T.C.Toye

532.527

90. DETERMINATION OF THE RELATIVISTIC GAS FLOW TH AXIAL SYMMETRY (THE VORTEX CASE). A.Arȳnov.

kl. Akad. Nauk. SSSR, Vol. 125, No. 3, 512-14 (March 21, 1959). Russian.

The relativistic sound equations and the vorticity equations are ed to give a solution to the flow field in terms of pseudovelocities. e solution is related to the method of characteristics used in gas namics. P.G.Morgan

532.529

91. THE DISPLACEMENT OF A TWO-COMPONENT MIXTURE HEN THE VISCOSITY OF ONE OF THE FLUIDS BEING DIS- ACED IS LOW. D.A.Éfros.

okl. Akad. Nauk SSSR, Vol. 121, No. 1, 59-62 (July 1, 1958). Russian. English translation in: Soviet Physics—Doklady ew York), Vol. 3, No. 4, 727-31 (July-Aug., 1958).

Derivation of the flow equations in a three component system nen two components are displaced by a third. The results are of e in calculating petrol and gas yields from flooded bore-holes. esults on kerosene—nitrogen mixtures displaced by water give od support to the theoretical equations derived. T.C.Toye

532.582 : 518.5

92. ELECTRIC NETWORK ANALOG STUDY OF VISCOUS FLOW ORMAL TO PARALLEL, EVENLY SPACED CYLINDERS. L.Shearer.

extile res. J., Vol. 29, No. 6, 467-70 (June, 1959).

In connection with the study of viscous flow of liquids and gases etween textile fibres, an electric resistance network analogue was nployed to solve the Navier—Stokes equations for creeping flow ormal to an infinite array of circular cylinders arranged in a exagonal pattern. The results of the analogue study predict flow esistance approximately four times as great as those measured th real packages of fibres. The factor of four difference between edicted and experimentally measured resistances is very likely e to the uneven spacing of fibres in the real case, giving some ry large passages which offer relatively little resistance to a gnificant fraction of the flow. However, the variation of flow res- tance with porosity appears the same, on a percentage basis, for e analogue prediction based on equally spaced fibres as for the perimentally measured resistance of real fibre masses which e unequally spaced in a random fashion. Thus neither the pred- ted nor measured flow resistance varies with fibre mass porosity accordance with the Carman—Kozeny formula which has been ccessfully applied to flows through granular beds; there is now tle reason to believe that the large variation of the Kozeny onstant" with porosity of the fibre mass is due simply to shift of ssage size distribution with degree of packing of the textile fibres.

532.582.81

93. A UNIVERSAL FORMULA FOR RATE OF DESCENT OF A PHERE IN FLUID. K.S.Shifrin.

v. Akad. Nauk SSSR, Ser. geofiz., 1958, No. 2, 280-2. In Russian. nglish summary: PB 141042T-1, obtainable from Office of echnical Services, U.S. Dept. of Commerce, Washington, D.C., S.A.

The speed v of steady fall under gravity of a [solid] sphere of ensity [excess] σ and radius a in fluid of density ρ and viscosity μ is deduced from the known universal relationship $C_D = f(R)$ connecting drag coefficient ($C_D = D/\frac{1}{2}\pi a^2\rho v^2$) and Reynolds number ($R = 2a\rho v/\mu$). The general formula for v can be written as $R = \Phi(x)$, where $x = 4a^3\sigma\rho g/9\mu^2$. Stokes's formula is $\Phi(x) = x$. For small R,

$$\frac{\Phi(x)}{x} = 1 - \frac{3x}{16} + \frac{109x^2}{1280} - \frac{1031x^3}{20480}$$

with $< 3\%$ error when $x < 1$. For large R, C_D has a constant value (about 0.5) and $\Phi(x) = (24x/C_D)^{1/2}$. For all R, $\Phi(x) = x/(1 + 0.15x^{1/2})$ with $< 14\%$ error; this is proposed as an improvement on Schmidt's empirical formula for falling raindrops. J.G.Oldroyd

532.584

9294. THE COLLISION OF PARTICLES IN SUSPENSION IN A FLUID STREAM. E.G.Richardson.

Proc. Univ. Durham Phil. Soc. A, Vol. 13, No. 10, 89-97 (1959).

A review of work on the collection of particles by an obstacle placed in a stream and on coagulation in turbulent flow.

R.Schnurmann

532.584

9295. OUTFLOW OF FLUIDIZED SYSTEMS: SOLID—GAS [FLOW] THROUGH SMALL-DIAMETER HOLES.

L.Massimilla, V.Betta and C.Della Rocca.

Ricerca sci., Vol. 29, No. 5, 1030-9 (May, 1959). In Italian.

Solid—air jets were produced by drilling holes ranging from 3 to 7 mm at the bottom of a fluidizing column of 90 mm i.d. Several materials were studied: silica sand, iron sand, dusted limestone, dusted coke, sawdust and glass beads. Solid and gas flow rates were measured and correlated with pressure drop and hole diameter. In order to interpret the experimental results, a model was studied which accounted for both phenomena occuring in jetting from fluidized beds, i.e. filtration of air and the dragging of the granules. Two equations were derived which were found to be satisfactory in correlating most of experimental data obtained.

532.61 : 536.441

9296. THE SURFACE TENSION OF LIQUIDS AT THE CRITICAL POINT. N.Barbulescu.

J. Chim. phys., Vol. 56, No. 2, 185-7 (Feb., 1959). In French.

The interfacial tension between a liquid and its saturated vapour vanishes at the critical point, whereas the surface tension remains finite. This has been calculated for six non-associated liquids (ether, methyl formate, ethyl acetate, carbon tetrachloride, benzene, and monochlorbenzene). It is of the order of 10^{-2} dynes/cm, irrespective of whether the temperature dependence of surface tension is used, or the Eötvös rule, or the relationship between surface tension, internal pressure, and molecular diameter.

R.Schnurmann

532.61.08

9297. USE OF HYSTERESIS OF WETTING FOR MEASURING SURFACE TENSION. J.J.Bikerman.

J. phys. Chem., Vol. 62, No. 12, 1534-6 (Dec., 1958).

The hysteresis of wetting observed when a partially wetted vertical slide is moved in and out of a liquid can be used to calculate the surface tension of the liquid. The vertical displacement of the liquid surface

$$h_2 - h_1 = (2\gamma/g\rho)^{\frac{1}{2}}(M_2^{\frac{1}{2}} - M_1^{\frac{1}{2}}),$$

$$\text{if} \quad M_2 = 1 - (1 - F_2^2/L^2\gamma^2)^{\frac{1}{2}},$$

$$\text{and} \quad M_1 = 1 - (1 - F_1^2/L^2\gamma^2)^{\frac{1}{2}};$$

F_1 and F_2 are the capillary forces on the slide at the two positions of the surface, L is the length of the 3-phase boundary, γ is surface tension, g is acceleration due to gravity, and ρ the density of the liquid. The method was tested successfully on water and mercury and is suitable for the latter liquid.

532.61.08

9298. EXTENSION OF THE TABLE FOR THE CALCULATION OF SURFACE TENSION FROM MEASUREMENTS OF SESSILE DROPS. K.G.Parvatikar.

Indian J. Phys., Vol. 32, No. 4, 174-8 (April, 1958).

An extension of Abstr. 6321 (1952). A table is prepared of the value of a^2/r^2 against h/r in the range from 0.570 to 0.978 at intervals of 0.001.

532.61.08

9299. A COMPACT INSTRUMENT FOR THE MEASUREMENT OF SURFACE TENSION OF LIQUIDS. P.D.Pathak and R.M.Patel.

Indian J. Phys., Vol. 32, No. 10, 464-7 (Oct., 1958).

The method of balancing the downward force of surface tension on the edge of a thin glass plate by the upward hydrostatic pressure of the liquid is used. The instrument is quite compact, handy and sensitive and can be used for rapid measurement on a number of samples.

532.612 : 621-47

CONDITIONS FOR THE INSERTION OF A GLASS FIBRE INTO A MOLTEN METAL, AGAINST SURFACE TENSION, WITHOUT BENDING. See Abstr. 9124

532.612.3

9300. THE SURFACE TENSION OF METALLIC INDIUM.

O.A.Timofeevicheva and P.P.Pugachevich.
Dokl. Akad. Nauk SSSR, Vol. 124, No. 5, 1093-4 (1959). In Russian.

Measurements are made by the method of the maximum pressure in droplets and evaluated by the formula of Cantor. The surface tension (γ) of indium within the range of temperatures 150-500° C is represented by the formula

$$\gamma = 569.3 - 0.085\ t.$$

R.Eisenschitz

532.62

9301. THE SPLITTING OF THIN LIQUID FILMS. KINEMATICS.

R.R.Myers, J.C.Miller, and A.C.Zettlemoyer.
J. Colloid Sci., Vol. 14, No. 3, 287-99 (June, 1959).

The kinematics of film splitting have been explored inside a roll nip using a disk and cone apparatus especially developed for the purpose. High-speed photographs and cinematographs have been made of the action in the nip. Two regimes of flow have been discerned. At slow speeds, fluids have time to flow counter to the roll direction into the region of low pressure where separation begins. At high speeds, cavitation or bubble formation occurs in the low-pressure region. The number of bubbles formed has been counted as a function of speed, nip pressure, and film thickness: they increase with increases in the first and third of these variables, and decrease slightly with increase in the second. Pigmentation increases the number of bubbles formed. These cavitation studies have shed light on the mechanisms of film splitting and fluid transfer.

532.65 : 551.574.1

9302. A THEORETICAL ESTIMATE OF THE COLLECTION EFFICIENCIES OF SMALL DROPLETS.

T.Pearcey and G.W.Hill.
Quart. J. Roy. Meteorol. Soc., Vol. 83, 77-92 (Jan., 1957).

The effective collision cross-sections between pairs of small water droplets, falling freely through air under the influence of gravity, have been computed on the assumption of hydrodynamical effect alone being important. It has been assumed that each droplet tends to fall freely at its terminal velocity with respect to the surrounding medium, which also moves under the influence of the motion of a neighbouring droplet. By the use of previously computed fields of flow of a viscous medium around a uniformly translated sphere, the trajectories of motion of one droplet with respect to another were computed for a range of droplets having radii between 4 and 200 μ. It is found that the collision cross-section, increase to values considerably greater than the corresponding geometrical cross-section as the droplets approach equality of size. As the difference in size increases, the collision cross-section decreases to values close to the geometrical cross-section, and finally decreases to zero. For any one particular size of the collecting droplet there is a minimum size of collected droplet below which no collection is possible. This size decreases with increasing size of the larger droplet greater than 10 μ in radius. For droplets smaller than 10 μ in radius, collision can occur only between droplets of nearly equal size. The results could account for coalescence becoming an important factor in the rapid formation of raindrops of radii greater than 10 μ.

MOLECULAR THEORY OF LIQUIDS

532.7 : 536.42

CELL THEORY OF LIQUIDS : APPLICATION TO PHASE TRANSITIONS. See Abstr. 8034

532.7 : 537.36

THE ELECTROKINETICS OF LIQUID METALS. See Abstr. 8181

532.72

9303. THERMAL DIFFUSION IN METHANOL—CARBON TETRACHLORIDE MIXTURES.

P.Crowther and C.J.G.Raw.
Proc. Phys. Soc., Vol. 73, Pt. 4, 686-7 (April, 1959).

The results were obtained from a simple parallel-plate apparatus in which the (horizontal) plates were 9 mm apart and had a temperature difference of 35 deg C (the hot plate on top). Analysis of the samples drawn from the hot and cold plates was carried out using the Abbé refractometer. Maximum separation occurs at an initial methanol mole fraction of about 0.46. Soret coefficients are evaluated. W.Good

532.72

9304. MULTICOMPONENT DIFFUSION AND FICK'S LAW.

E.L.Knuth.
Phys. of Fluids, Vol. 2, No. 3, 339-40 (May-June, 1959).

An analytical attempt to make clear the model of a multicomponent mixture implicit in Fick's law for mass flux.

$$\rho_i V_i = -\rho D \text{ grad } c_i$$

ρ = density ρ_i = density i^{th} chemical specie
D = diffusion coefficient, $c = \frac{\rho_i}{\rho}$

It is found that the law is only a good approximation for the diffusion of a group of molecular species of approximately the same molecular weight. T.C.Toye

532.73

9305. METAL SOLUTIONS.

M.C.R.Symons.
J. chem. Phys., Vol. 30, No. 6, 1628-9 (June, 1959).

Detailed empirical arguments enable a choice to be made between the "expanded metal" and "solvent cavity" models for solutions of alkaki metals in ammonia and ethers. It is found that the former model is applicable for electron-paired species, and the latter for the unpaired species. J.Hawgood

532.73 : 539.19

9306. CONCENTRATED MACROMOLECULAR SOLUTIONS.

B.H.Zimm.
Rev. mod. Phys., Vol. 31, No. 1, 123-9 (Jan., 1959).

In concentrated solutions of biological polymers there is interaction between the macromolecules and in addition interaction between the macromolecules and the solvent molecules. Methods of investigating these interactions are discussed and some of the theories which have been developed to explain the experimental observations are outlined. J.Iball

532.77

9307. INVESTIGATION OF THE STRUCTURE OF LIQUID Bi—Sn ALLOYS.

N.V.Alekseev and Ya.I.Gerasimov.
Dokl. Akad. Nauk SSSR, Vol. 121, No. 3, 488-91 (1958). In Russian.

The diffraction of electrons from thin films, 300 A thick, of Bi—Sn alloys at a temperature of 290° was used to determine their radial distribution functions. In pure Sn, the first maximum of this function corresponds to 10 nearest neighbours at a distance of about 3.25 A. In pure Bi, it corresponds to 7 nearest neighbours at 3.85 A. The curve for the eutectic mixture is interpreted as showing that each Sn atom is surrounded by 7.8 Sn atoms at 3.35 A distance and 2.1 Bi atoms at 3.85 A whilst each Bi atom is surrounded by 5.2 Bi atoms at 4.15 A and 2 Sn atoms at 3.85 A. Alloys of intermediate concentrations are studied in a similar way. O.Penrose

532.77 : 539.19

STRUCTURE OF SILICO-TUNGSTIC ACID IN AQUEOUS SOLUTION. See Abstr. 8757

532.78

9308. STRUCTURE OF WATER.

I.Z.Fisher and V.K.Prokhorenko
Dokl. Akad. Nauk SSSR, Vol. 123, No. 1, 131-2 (1958). In Russian.

Values of the fluctuations of the first two coordination numbers in water at low temperatures, calculated from the angular variation of the radial atomic X-ray scattering function, are found to be approximately identical and very high, of the same order, or even higher, than in other simple liquids (e.g. argon). Therefore, in spite of quaternary coordination, water is no more quasi-crystalline than other simple liquids. R.C.Murray

532.783 : 538.27

9309. LINE SHAPES OF PROTON MAGNETIC RESONANCE ABSORPTION IN LIQUID CRYSTALS.

H.Lippmann and K.H.Weber.
Ann. Phys. (Leipzig), Vol. 20, No. 1-6, 265-79 (1957). In German.

A marked fine structure was observed in the proton resonances in the homologous series of 4,4'-dialkoxyazoxybenzenes. The line idths and second moments decreased with increasing temperature. t the melting and clarifying points significant changes in line shape ere observed. The central component arising from the methyl rotons for the first of the series was only resolved in homologues ith odd numbers of C atoms in the alkoxy chains. The smectic hase of the corresponding heptyl compound behaves as a liquid rystal which can be rotated in a magnetic field without disturbing e ordered state obtained by cooling from the nematic phase. xperiments using this property indicate that the long molecular xes have the same angular distribution in the nematic phase as in e smectic phase obtained by cooling in a magnetic field, with a aximum in the direction of that magnetic field. A.J.Manuel

532.783 : 538.27

310. INVESTIGATION OF THE PROTON MAGNETIC RESONNCES IN THE LIQUID CRYSTAL 4,4'-DIPROPOXYAZOXYENZENE. K.H.Weber.
. Naturforsch., Vol. 13a, No. 12, 1098-100 (Dec., 1958). In German.

A continuation of earlier work (see preceding abstract). The hanges in line shape and second moment over a temperature range cluding the melting and clarifying points are reported. The reults are discussed with reference to the symmetry of the molecule. A.J.Manuel

532.783 : 538.27

311. NUCLEAR RESONANCE INVESTIGATIONS IN LIQUID RYSTALS: ON THE QUESTION OF THE STATE OF MOLECULAR RDER IN MAGNETICALLY ORDERED LIQUID CRYSTAL PHASES F THE SMECTIC TYPE. K.H.Weber.
. Naturforsch., Vol. 14a, No. 2, 112-20 (Feb., 1959). In German.

A continuation of earlier work (see preceding two abstracts). rom the dependence on temperature and specimen orientation of e line shapes and second moments of the proton resonances in ,4'-diheptoxyazoxybenzene and 4,4'-dicarbethoxyazoxybenzene, inrmation about the state of molecular order in a magnetic field derived. A.J.Manuel

MECHANICS OF GASES

VACUUM TECHNIQUE

533.5

312. STUDY OF AN EVAPORATION AND IONIZATION VAPOR-ION] PUMP. E.Thomas.
ull. Acad. Roy. Belgique Cl. Sci., Vol. 42, No. 7, 778-83 (1956). French.

A vacuum pump is described which works on the principle of e ion pumping of gases and of the gettering by titanium, which vaporates continuously and condenses on the inner wall of the mp. The mechanism for the feeding of titanium is also described.

533.5 : 531.788.7

313. RADIOACTIVE IONIZATION GAUGE FOR HIGH VACUUM. .I.Akishin.
ribory i Tekh. Eksper., 1959, No. 2, 78-80 (March-April). Russian.

Details are given of an ionization gauge, which uses a 10 μc o^{210} source inside an electron multiplier, the resulting ionization lses being amplified and registered. The graphs of the count rate d pressure (between 10^{-3} and 10^{-5} mm Hg) are given for argon, lium and air, showing linear relationship. It is suggested that by mbining this gauge with a standard radioactive ionization gauge orking between 10^{2} and 10^{-3} mm Hg), a gauge can be constructed r the range between 10^{2} and 10^{-6} mm Hg. J.M.Zarzycki

533.5 : 531.788.7

314. IONIZATION GAUGE FOR THE MEASUREMENT OF RESSURES BETWEEN 10^{-4} AND 10^{-10} mm Hg.
M.Gavril'uk and Ya.M.Kucherov.
ribory i Tekh. Eksper., 1959, No. 2, 83-5 (March-April). Russian.

An improved version of Bayard and Alpert's (Abstr. 7792 of 50) ionization gauge head is described in detail. It is claimed at by increasing the size of the grid, the sensitivity is increased 30 μA per mA per μ Hg. J.M.Zarzycki

533.5 : 531.789

15. ON THE SENSITIVITY OF LEAK DETECTORS OF THE ELIUM MASS SPECTROMETER TYPE. S.Choumoff.
de, Vol. 13, 193-6 (July-Aug., 1958). In French.

The author reports some leak detection measurements in the region 10^{-6} lusec, i.e. three orders smaller than that of the normal calibrated leak. It is suggested that the extrapolation procedure commonly used with the latter is invalid and leads to a pessimistic limit for the helium leak detector. A.E.I. Research Laboratory

533.6.011.3

9316. SUBSONIC FLOW AROUND [SOLID] ELLIPSES WITH CIRCULATION. P.I.Chushkin.
Dokl. Akad. Nauk SSSR, Vol. 125, No. 4, 748-51 (April 1, 1959). In Russian.

The distribution of velocities of a flowing gas was obtained by computation. Flow in two dimensions is considered. It is assumed that the movement is irrotational; dissipative effects are neglected. Results are tabulated. R.Eisenschitz

MOLECULAR THEORY OF GASES

533.7

9317. EQUATIONS FOR A ONE-COMPONENT LATTICE GAS WITH "ISING" INTERACTION. J.Czerwonko.
J. chem. Phys., Vol. 31, No. 1, 118-21 (July, 1959).

The thermodynamical properties of a lattice gas, the atoms of which interact according to their mutual orientations, are described. Expressions are obtained for the thermodynamical potential, mean value of energy, the average number of particles, and average orientations by means of the variational method of Bogolubov. It was shown that in this case there exists a phase order—disorder transition, the temperature of which was calculated.

VIBRATIONS . ACOUSTICS

534.12

9318. VIBRATION OF UNIFORM SQUARE PLATES BOUNDED BY FLEXIBLE BEAMS. H.L.Cox and W.A.Benfield.
J. Acoust. Soc. Amer., Vol. 31, No. 7, 963-6 (July, 1959).

The fundamental frequencies of flexural vibration are determined for uniform isotropic square plates that have pinpoint supports at the four corners and flexible beams along the edges. The flexible beams are pinned to the plate so that the beams resist only deflection of the plate boundaries. Finite difference solutions, which simplify the treatment of the boundary conditions for definite values of Poisson's ratio, are used to obtain the approximate solutions.

534.121

9319. RESPONSE OF PLATES TO A DECAYING AND CONVECTING RANDOM PRESSURE FIELD. I.Dyer.
J. Acoust. Soc. Amer., Vol. 31, No. 7, 922-8 (July, 1959).

Following the methods of Lyon, an analysis of the vibratory response of a plate to a random pressure field is given. The pressure correlation of the random field is assumed to have a scale small compared to the plate size, to decay exponentially, and to convect with constant speed over the plate. Two cases are considered, one in which the convection speed is much less than the speed of free flexural waves in the plate, the other in which the convection speed is the same order as the flexural wave speed. The mean square plate displacement is shown to be relatively independent of convection for speeds much less than the flexural wave speed, and to increase significantly for speeds in the order of the flexural wave speed. It is shown that damping is usually, but not always, an effective means of vibration reduction. In the case of convection speeds much smaller than the flexural speed, the use of hysteretic damping for reduction of the displacement response is shown to be limited by the decay of the assumed random pressure field.

534.22

9320. ON THE CALCULATION OF THE VELOCITY OF SOUND IN SEA WATER. C.Froese.
Canad. J. Phys., Vol. 37, No. 6, 775-9 (June, 1959).

Kuwahara's tables (1939) for the velocity of sound in sea water as affected by salinity, temperature and pressure, are checked using an automatic computer. The original and revised values are compared in tables and graphs. R.F.S.Hearmon

534.22 : 532.7

9321. VARIATION OF ACOUSTIC VELOCITY WITH TEMPERATURE IN AQUEOUS SOLUTIONS OF CERTAIN INORGANIC SULFATES. G.W.Marks.

J. Acoust. Soc. Amer., Vol. 31, No. 7, 936-46 (July, 1959).

Much can be learned about the molecular properties of liquids and solutions from investigations concerning acoustic velocity and attenuation. However, systematic studies are needed. Sound velocities in aqueous solutions of Li_2SO_4, Na_2SO_4, $KHSO_4$, K_2SO_4, $(NH_4)_2SO_4$, and $MgSO_4$ were measured over wide ranges of concentration and over the temperature range 0° to 80°C. It was found that the sound velocity v. temperature curves rise and are displaced toward lower temperatures with increase in concentration. Except at concentrations above about one molar the curves are, within the limits of experimental error, the same as the displaced curve for water. The specific acoustic impedence of these sulphate solutions varies linearly with concentration at 20°C. Adiabatic compressibilities are well represented by an empirical expression. Relative association was found to rise with increase in concentration. This is because of solvation of the ions in solution. From the available data apparent molal compressibilities were computed for the temperature range 15° to 35°C.

534.222.2

9322. ON THE EXACT SOLUTIONS OF THE EQUATIONS OF ONE-DIMENSIONAL GAS-DYNAMICS WITH SHOCK- AND DETONATION-WAVES. I.S.Shikin.

Dokl. Akad. Nauk SSSR, Vol. 122, No. 1, 33-6 (1958). In Russian.

A general method is developed for discussing problems of shock waves and detonation waves. This is achieved by using as a starting point the previously derived basic equations of Sedov [Metody podobiya i razmernosti v mekhanike. Moscow (1957)], and determining the initial density, initial pressure, and the law of motion of the surface of the discontinuity from the conditions for shock- and detonation-waves. P.Roman

534.222.2 : 533.7

9323. ON EXACT SOLUTIONS OF CERTAIN GAS-DYNAMICAL EQUATIONS. S.S.Grigoryan.

Dokl. Akad. Nauk SSSR, Vol. 121, No. 4, 606-9 (1958). In Russian. English translation in: Soviet Physics — Doklady (New York), Vol. 3, No. 4, 732-5 (July-Aug., 1958).

The one-dimensional motion of a thermally insulating gas is studied, with the idea of showing that a shock wave can be followed by a second shock wave which never overtakes it. The equations of motion are reduced to ordinary differential equations by assuming a special type of motion where the dependent variables initially vary exponentially with position. A diagram of the solution curves of this equation is used to discuss motions involving: (a) no shock wave; (b) one shock wave; (c) a suitably moving piston and one shock wave; (d) a suitably moving piston and two shock waves. In case (d) the rear shock wave never overtakes the front one; in fact their separation in time is constant. O.Penrose

534.222.2 : 541.126

9324. THE INTERACTION OF SHOCK WAVES WITH A FLAME FRONT. S.M.Kogarko, V.I.Skobelkin and A.N.Kazakov.

Dokl. Akad. Nauk SSSR, Vol. 122, No. 6, 1046-8 (1958). In Russian.

The problem of the amplification of a shock wave by its interaction with a flame front, giving a change in the normal burning process, is discussed. The shock wave is refracted and reflected at the flame front but also compresses the gas in the reaction zone, thereby increasing its temperature. This increases the reaction velocity and the flame propagation velocity. This happens quickly enough to give rise to two additional shock waves moving in opposite directions from the flame front. Calculations are made of the dependence of the amplitude of the amplified shock wave on the compression within the reaction zone for flame front velocities of 1 and 5 m/sec. M.G.Priestley

534.222.2

9325. ANALYSIS OF VIBRATIONAL RELAXATION DATA IN SHOCK WAVE EXPERIMENTS. K.E.Shuler.

J. chem. Phys., Vol. 30, No. 6, 1631-2 (June, 1959).

An analysis is made of the vibrational relaxation between the quantized vibration levels of molecular harmonic oscillators in transient thermal environments. Specific applications to time resolved measurements of spectral intensities are indicated. R.W.Nicholls

534.222.2

9326. EXPERIMENTS ON THE CYLINDRICAL BLAST WAVES. K.Ōshima.

J. Phys. Soc. Japan, Vol. 12, No. 12, 1421 (Dec., 1957).

Schlieren and interferometric studies have been made of cylindrical blast waves from exploding wires. Interferograms of Mach and regular reflections of these from a flat surface are shown. The so-called slip flow cannot be recognized, and the transition angle from regular to Mach reflection is greater than for a plane shock wave. A.G.Gaydon

534.222.2

9327. VISUALIZATION OF CYLINDRICAL SHOCK WAVES. F.D.Bennett and D.D.Shear.

Phys. of Fluids, Vol. 2, No. 3, 338-9 (May-June, 1959).

The shock wave from an exploding wire is made visible by reflecting light from the explosion back through the shock front. The growth of the wave can be followed in streak photography (Abstr. 1196 of 1959). The shock front is more easily visible when an array of shiny wires is the reflector. The reflecting wires are parallel to the direction of the camera sweep. E.R.Wooding

534.222.2

9328. REFLECTION AND REFRACTION OF SHOCK WAVES AT THE BOUNDARY OF TWO MEDIA. I. NORMAL IMPACT. A.I.Gubanov.

Zh. tekh. Fiz., Vol. 28, No. 9, 2035-40 (Sept., 1958). In Russian. English translation in: Soviet Physics — Technical Physics (New York), Vol. 3, No. 9, 1869-74 (1958).

Equations are developed for the pressure in reflected and refracted shock waves for the case of the normal impact of plane shock waves on a boundary separating two media. Approximate solutions are obtained for the case of small intensity shock waves, for the particular cases of two similar media and two widely different medi P.G.Morgan

534.222.2 : 539.2

SHOCK-WAVE COMPRESSION MEASUREMENTS ON METALS. See Abstr. 8791

534.222.2 : 537.56

SHOCK WAVES REFLECTED BY MAGNETIC FIELDS. See Abstr. 8257

534.23

9329. INFLUENCE OF FLUID MOTION PAST A PLANE BOUNDARY ON SOUND REFLECTION, ABSORPTION, AND TRANSMISSION. U.Ingard.

J. Acoust. Soc. Amer., Vol. 31, No. 7, 1035-6 (July, 1959).

It is shown that the effect of fluid motion past a plane boundary on the reflection and absorption of sound is equivalent to an increas of the normal acoustic impedance of the boundary by a factor $(1 + M \sin\phi)$, where ϕ is the angle of incidence of the sound wave, and M is the Mach number of the flow velocity component in the incidence-reflection plane of the wave. Similarly, the acoustic energy flux perpendicular to the boundary and the flow is shown to be increased by the same factor. Reflection and transmission coefficients of a thin solid interface between a fluid in motion and one at rest are given. Furthermore, some comments on the problem of transmission in ducts are given. For propagation between two plane parallel boundaries with the same acoustic admittance, it is found for sufficiently small values of the admittanc that the sound pressure attenuation constant of the fundamental mod is modified approximately by the factors $(1 + M)^{-2}$ and $(1 - M)^{-2}$ for downstream and upstream propagation, where M is the flow Mach number.

534.23 : 537.312.62

9330. ULTRASONIC ATTENUATION OF METALS AT LOW TEMPERATURES. K.D.Chaudhuri.

Z. Phys., Vol. 155, No. 3, 290-5 (1959).

For very low temperatures, when the mean free path of the electrons in metals becomes large, but less than the wavelength of the sound wave, a relationship between electrical conductivity and attenuation in the normal state has been deduced by Mason (Abstr. 2518 of 1955) using the mean free path associated with the electrica conductivity. Similarly, a relationship between thermal conductivit and attenuation can be deduced using the mean free path associated with the thermal conductivity. It has been shown from experimental results that the relationship thus deduced agrees better in the temp- erature region discussed in the present paper. When the mean free ath becomes greater than the wavelength, α_s/α_n, the ratio of superonducting attenuation to that in the normal state can be determined accordance with the B.C.S. theory . It is apparent from experinental results that in the limited region where the scattering of lectrons is predominantly by lattice vibrations, K_s/K_n, the ratio of uperconducting thermal conductivity to that in the normal state is qual to α_s/α_n.

534.23 : 537.312.62

STUDY OF PHASE PROPAGATION IN SUPERCONDUCTING LUMINIUM BY ULTRASONIC ATTENUATION MEASUREMENTS. ee Abstr. 8162

534.23 : 539.2

ULTRASONIC ATTENUATION BY ELECTRONS IN METALS. ee Abstr. 8807

534.23

331. SOUND TRANSMISSION THROUGH A VELOCITY ISCONTINUITY. P.Gottlieb.

. Acoust. Soc. Amer., Vol. 31, No. 7, 1036-7 (July, 1959).

The attenuation of a sound wave in a steady flow, with the flow radient normal to the flow lines, is approximated by three different ethods. The first method approximates the steady flow by layers f constant velocity and applies the boundary conditions of Ribner see Abstr. 7683 of 1957) at each interface. The second method uses he analytic solution for the continuous flow. The last method is imilar to the first but uses the boundary conditions of earlier uthors. It is found that the first and second methods give the same nswer, and this answer disagrees with that obtained by the third ethod.

534.23

332. THERMOSONICS. S.Parthasarathy.

. sci. industr. Res., Vol. 18A, No. 1, 13-16 (Jan., 1959).

Survey of the literature concerning, for ultrasound propagation in iquids, (a) the relation between the sound energy and heat energy roduced on absorption, and (b) the determination of sound absorption oefficients, transducer conversion efficiencies and vibration ampliudes from temperature measurements in the liquid.

H.D.Parbrook

534.23 : 539.215.2

THE USE OF ULTRASONIC WAVES IN INVESTIGATING THE TRUCTURE OF STEELS. See Abstr. 8877

534.231

333. DEPENDENCE OF THE FREQUENCY OF FIELD PULSAIONS AT THE FOCUS OF A LENS ON DIAPHRAGM DIMENSIONS. .A.Blyakhman and L.A.Chernov.

kust. Zh., Vol. 5, No. 1, 21-4 (1959). In Russian.

The authors calculated the root-mean-square value of the requency of pulsations of a wave which passed through a medium ith inhomogeneities. Dependence of this frequency at the focus of lens on the lens diaphragm aperture was found to be the same for andom and for ordered motions of the inhomogeneities causing the ulsations; the case of ordered motion of the inhomogeneities was iscussed earlier by Blyakhman (Abstr. 6762 of 1958). This dependnce agrees well with the experimental data obtained by Nettelblad 1953) in observation of the scintillation of stars.

A.Tybulewicz

534.232

334. ACOUSTIC INTERACTION IN VENTED LOUDSPEAKER NCLOSURES. E. de Boer.

. Acoust. Soc. Amer., Vol. 31, No. 2, 246-7 (Feb., 1959).

Theoretical consideration of the interaction between the two adiating openings when their dimensions are small compared to he radiated wavelength.

H.D.Parbrook

534.232

335. CALIBRATION OF TWO TRANSDUCERS ASSUMED DENTICAL. R.J.Urick.

. Acoust. Soc. Amer., Vol. 31, No. 2, 251 (Feb., 1959).

Brief description of a simplified reciprocity calibration.

H.D.Parbrook

534.232

336. MUTUAL RADIATION IMPEDANCE OF SOURCES ON A PHERE. C.H.Sherman.

. Acoust. Soc. Amer., Vol. 31, No. 7, 947-52 (July, 1959).

Expressions for the mutual radiation impedance coefficient are erived in the cases of uniformly vibrating circular and rectangular acoustic sources on a rigid spherical baffle. Numerical results for circular sources on a sphere are given as a function of the source spearation for several values of ka (a is the radius of the sphere and k is the wave number). The interaction between circular sources on a large sphere and on a plane is compared numerically.

534.232

9337. DISTRIBUTION OF SOUND SOURCES IN A JET STREAM. I.Dyer.

J. Acoust. Soc. Amer., Vol. 31, No. 7, 1016-22 (July, 1959).

It is shown that the axial distribution of sound sources in a turbulent jet stream can be found simply in terms of (1) the spectrum of the total radiated power and (2) the frequency of the sources as a function of location along the jet axis. With the use of existing data on the sound power spectrum and recently reported but preliminary data on the frequency dependence of the most probable source location, an approximate axial distribution is derived. The derived distribution is in agreement with calculations by Sanders (Gen. Eng. Lab. Rep. No. 57 Gt 222, General Electric Company, July 1, 1957) based on turbulence measurements, and with calculations by Ribner based on Lighthill's theory (see Abstr. 4408 of 1959; 3188 of 1954).

534.24 : 551.481.18

ACOUSTIC CHARACTERISTICS OF A FLORIDA LAKE BOTTOM. See Abstr. 9060

534.26

9338. FIELD FLUCTUATIONS NEAR THE FOCUS OF A LENS. M.N.Krom.

Akust. Zh., Vol. 5, No. 1, 45-50 (1959). In Russian.

A diffraction image, produced by a focusing system, pulsates if there are fluctuations of amplitude or phase in the incident wave. Such disturbances in the diffraction image of a star, due to atmospheric turbulence, were reported by Danzhon and Kude (1940). Field fluctuations near or at the focus of a lens were dealt with by Krasil'nikov and Tatarskiĭ (1953), assuming that fluctuations in the incident wave are small. Chernov (Abstr. 4815 of 1958) found the spatial distribution of field fluctuations near the focus of a paraxial lens for arbitrary amplitude and phase of fluctuations in the incident wave. Because of mathematical difficulties, Chernov discussed conditions at the focus itself and only in the case of large and small fluctuations in the incident wave. In practice such fluctuations are usually neither small nor large. The present paper continues Chernov's work and reports calculations of the distribution of field pulsations near the focus of a large lens when the incident wave has fluctuations of arbitrary magnitude. The author also studied the dependence of the relative pulsations at the focus on the dimensions of the objective.

A.Tybulewicz

534.26 : 517.9

9339. INVERSION FORMULA FOR THE SOMMERFELD INTEGRAL. G.D.Malyuzhinets.

Dokl. Akad. Nauk SSSR, Vol. 118, No. 6, 1099-102 (1958). In Russian. English translation in: Soviet Physics — "Doklady" (New York), Vol. 3, No. 1, 52-6 (Jan.-Feb., 1958).

The author has previously extended the Sommerfeld integral to diffraction problems with Cauchy boundary conditions ["Certain Generalizations of the Reflection Method in the Theory of the Diffraction of Sinusoidal Waves" (Doctoral Dissertation) (FIAN, Moscow, 1950)]. In this paper he shows formally that it can also be used (after suitable modifications) to solve boundary value problems in wedge-like regions with derivatives of arbitrary order at the boundary, in particular the problem of the diffraction of sound waves by a half-infinite elastic plate.

J.K.Skwirzynski

534.26

9340. DIFFRACTION OF A PLANE SOUND WAVE BY A SEMI-INFINITE THIN ELASTIC PLATE. G.L.Lamb, Jr.

J. Acoust. Soc. Amer., Vol. 31, No. 7, 929-35 (July, 1959).

The diffraction of a plane small amplitude sound wave incident upon a semi-infinite thin elastic plate is investigated theoretically. The problem is formulated in terms of an integral equation relating the discontinuity in pressure across the diffracting plate to its flexural displacement and the usual fourth order thin plate differential equation governing the flexural motion of the plate when driven by the pressure discontinuity. This pair of coupled equations is then shown to be amenable to solution by the Wiener—Hopf method (1931). A perturbation procedure, valid in the limit of increasing plate stiffness, is employed to obtain expressions for the sound fields radiated by and transmitted through the plate as well as for the diffracted sound field.

534.26

9341. SCATTERING OF SOUND BY ELASTIC CYLINDERS.

L.M.Lyamshev.

Akust. Zh., Vol. 5, No. 1, 58-63 (1959). In Russian.

The author obtained polar characteristics of reflection of acoustic waves on elastic cylinders 6 mm long and of 10 mm diameter, made of brass, aluminium and steel. Measurements were made in water in the direction opposite to the direction of the incident wave. The polar characteristics were obtained under pulse conditions using the author's own apparatus described earlier (1955). The pulses were of 30 msec duration and 50 c/s repetition frequency. The polar characteristics show maxima of strong scattering (non-specular reflection). A theoretical analysis of scattering of plane acoustic waves by infinite elastic cylinders indicated that strong non-specular reflection may be expected whenever free waves are excited in an elastic cylinder and propagated along it.

A.Tybulewicz

534.26

9342. SCATTERING OF PLANE WAVES BY A CYLINDRICAL CAVITY IN AN ISOTROPIC ELASTIC.

V.V.Tyutekin.

Akust. Zh., Vol. 5, No. 1, 106-10 (1959). In Russian.

The problem of scattering of elastic waves by cavities of various forms is of theoretical interest as well as being important in acoustic studies of defects. The author considers scattering of plane longitudinal waves by an infinite cylindrical cavity in an isotropic elastic medium in the case of normal incidence of the wave on the cavity. Expressions are obtained for scalar and vector potentials in the form of coefficients corresponding to a n-th cylindrical wave. The case $n = 0$ is discussed in detail. It is shown that at low values of the shear (rigidity) modulus resonance may occur in the cavity.

A.Tybulewicz

534.37

9343. DAMPING OF FLEXURAL WAVES BY A CONSTRAINED VISCOELASTIC LAYER.

E.M.Kerwin, Jr.

J. Acoust. Soc. Amer., Vol. 31, No. 7, 952-62 (July, 1959).

For a number of years it has been known that flexural vibrations in a plate can be damped by the application of a layer of damping (viscoelastic) material that is in turn constrained by a backing layer or foil. A common example is the damping tape currently used in aircraft. This paper presents a quantitative analysis of the damping effectiveness of such a constrained layer. As in the work of Oberst the damping is characterized by the loss factor η, which is the normalized imaginary part of the complex bending stiffness of the damped plate. The calculated damping factor depends on the wavelength of bending waves in the damped plate, and on the thickness and elastic moduli of the plate, the damping layer, and the constraining layer. A complex shear modulus is assigned to the damping layer, where all of the energy dissipation is assumed to take place. Damping factors have been determined experimentally on laboratory test bars for a number of constrained-damping-layer applications for frequencies from about 100 to 4000 c/s over a range of temperatures. Gratifying agreement with calculated damping has been found for variations in frequency, temperature and damped-bar geometry.

534.372

9344. ISOLATION FROM MECHANICAL SHOCK WITH ONE- AND TWO-STAGE MOUNTING SYSTEMS.

J.C.Snowdon and G.G.Parfitt.

J. Acoust. Soc. Amer., Vol. 31, No. 7, 967-76 (July, 1959).

The damaging potential of mechanical shock experienced by resiliently mounted equipment is discussed in general terms. It is pointed out that the displacement, relative displacement, and acceleration of the mounted item, expressed as nondimensional quantities, describe the likelihood of damage in particular circumstances. The performance of mounting systems has been judged by their response to a steplike shock displacement. The nondimensional quantities above have been determined as functions of the steepness of the leading edge of the step displacement for one- and two-stage, linear, viscously damped spring mountings. Heavy damping is beneficial in a mount in several respects, and its adverse effects on transmitted acceleration can be mitigated by the use of the two-stage mountings.

534.39

9345. DETERMINATION OF DISTANCE IN LIQUIDS BY ACOUSTIC TRANSIT-TIME TECHNIQUES.

H.H.Rust and H.Drubba.

Arch. tech. Messen, No. 278 (Ref. V1122-6), 45-8 (March, 1959). In German.

The salient features and parameters of ultrasonic echo-reflection technique are reviewed. These include: types of transducers, optimum frequency ranges, pulse-repetition rate, and temperature, density, absorption and reflection effects in the medium. Noise and parasitic-echo effects are also discussed and applications cited. The proposal to utilize the long-range sound-transmission property of ocean waters, where the existence of a sharp temperature change at a depth of about 1000 m produces a "waveguide" effect, is mentioned briefly.

H.G.M.Spratt

534.39 : 548.5

9346. THE QUESTION OF THE INFLUENCE OF ULTRASONIC VIBRATIONS ON THE SOLUTION PROCESS OF SINGLE CRYSTALS.

Kh.S.Bagdasarov.

Kristallografiya, Vol. 3, No. 1, 110-12 (1958). In Russian.

Experiments are described on potash alum at 2.5 Mc/s. The solution process was photographed by the Schlieren method. The ultrasonic vibrations influence the diffusion layer round the crystal and hence affect the velocity of solution. See also Abstr. 3571 of 1958.

R.F.S.Hearmon

534.614

9347. MEASUREMENT OF VELOCITY OF SOUND IN PLASTICS BY TRANSMISSION AND ECHO METHODS.

J.Nittel.

Exper. Tech. der Phys., Vol. 7, No. 1, 14-19 (1959). In German.

Circuit particulars are given of an ultrasonic impulse apparatus (0.8 to 4 Mc/s) suitable for measuring the velocity of sound in solids having strong acoustic absorption. Sound velocities in the range −40° to +50° C are quoted for 2 Buna rubbers.

H.J.H.Starks

534.7

PHYSIOLOGICAL ACOUSTICS. HEARING. See also the Section entitled "BIOPHYSICS. PHYSIOLOGICAL PHYSICS".

534.79

9348. ON THE VALIDITY OF THE LOUDNESS SCALE.

S.S.Stevens.

J. Acoust. Soc. Amer., Vol. 31, No. 7, 995-1003 (July, 1959).

Although encouraging progess has been made in the measurement of loudness, certain objections to the sone scale have been raised from time to time. This paper tries to answer some of these objections, and especially to show how the form of the sone scale can be verified by cross-modality matchings. Instead of working with numerical estimations of magnitudes or ratios, these new procedures allow observers to equate the apparent intensity of stimuli in two different sense modalities. It turns out that the results of these cross-modality matches can be predicted from the relation between the sone scale and the subjective scales in the other modalities. These experiments strengthen the evidence for the validity of the sone scale. They also suggest that the form of the subjective intensity function depends on the "input-output" operating characteristic of the sensory system and not on some prior experience which the observer may have had with a "physical correlate" of the stimulus.

534.83

9349. SIMILARITY AND TURBULENT JET NOISE.

A.Powell.

J. Acoust. Soc. Amer., Vol. 31, No. 6, 812-13 (June, 1959).

An independent analysis corroborates the work of Ribner (Abstr. 4408 of 1959) and also leads to predictions concerning the spectrum shape which correlate with experimental results except for the proportional scaling of peak frequency with velocity. Possible explanations of this are given.

H.D.Parbrook

534.83

9350. SOME NEAR- AND FAR-FIELD NOISE MEASUREMENTS FOR ROCKET ENGINES OPERATING AT DIFFERENT NOZZLE PRESSURE RATIOS.

W.H.Mayes.

J. Acoust. Soc. Amer., Vol. 31, No. 7, 1013-15 (July, 1959).

Measurements of near- and far-field noise pressures are presented for a 1650 lb thrust engine and for 6000-7500 lb thrust engines for which the nozzle exit pressure was changed systematically in order to study its effects on the noise level and spectra. Near-field surveys indicated that the highest noise pressure occurred at about 20 exit diameters distance downstream of the nozzle near the transition from supersonic to subsonic flow. At a radial distance of three exit diameters, the noise pressure levels varied from about 145 dB just upstream of the nozzle to about 170 dB downstream of the nozzl and no consistent trends were noted as a function of nozzle exit pressure. In general, the spectra at points downstream of the nozzle contained considerably more low-frequency noise than those measured upstream of the nozzle. It was noted that the maximum far-fie noise was radiated in the downstream direction at angles of 30° to 4 from the jet axis. The acoustical power radiated from all nozzles veraged about 0.5% of the the mechanical power of the exhaust ream, the least noise being radiated by the nozzle having an exit ressure less than atmospheric.

534.83

51. NOISE GENERATED BY TWO INTERACTING AIR JETS.
Ingard and G.C.Maling, Jr.
Acoust. Soc. Amer., Vol. 31, No. 7, 1031-3 (July, 1959).

It has been observed that the excess noise generated as a result the interaction or mixing of two small air jets is considerably eater than the noise produced by the individual jets. The "interac- on noise" produced by jets that lie in the same plane has been meas- red for jet intersection angles between 0° and 180°. Similar meas- rements have been made as a function of jet separation by using two ts that intersect at a 90° angle but do not lie in the same plane.

534.83 : 621.375.4

52. LOW-NOISE HYDROPHONE PREAMPLIFIER.
D.Macpherson.
ev. sci. Instrum., Vol. 30, No. 7, 533-5 (July, 1959).

Design and performance is described. Transistors are used roughout the circuit and it is shown that although the noise figure slightly worse than the equivalent circuit using vacuum tubes and ansformers, in practice the over-all performance is superior.

534.842

53. ACOUSTICAL PROBLEMS IN TWO ROUND CHURCHES.
E.Mikeska and R.N.Lane.
Acoust. Soc. Amer., Vol. 31, No. 7, 857-65 (July, 1959).

Acoustical measurements and design considerations are dis- ssed for two churches with circular floor plans. One was care- lly planned with the acoustics in mind and has proved successful. ne other was built with a parabolic concrete dome; a thin sprayed sorbent lining inside the dome was counted on to eliminate sound cusing effects. Echograms taken at several positions inside the urch illustrate the resulting severe echo problems.

534.842

54. ACOUSTICS OF SEVERANCE HALL.
S.Shankland and E.A.Flynn.
Acoust. Soc. Amer., Vol. 31, No. 7, 866-71 (July, 1959).

During 1958 a number of corrections were made in the acoustics Severance Hall designed to lengthen the reverberation time, pecially at the higher frequencies, and to project more sound ergy from the orchestra to the audience. An entirely new stage ell has been constructed of heavy wood and is tightly enclosed so at a large fraction of the orchestral sound is now directed to the dience. In addition, the shape of the stage shell provides a con- derable amount of mixing and blending of the sound, which is a eat advantage for the conductor and orchestra. This feature will so be important for the numerous recordings made by the Cleveland rchestra. The material and design of the heavy wood shell, floor, d risers for the stage, were chosen to achieve a large measure of eflection without undue resonance. Another important modification the simplification of the proscenium and removal of the heavy rtain which in effect brings the orchestra out into the auditorium a greater degree than before. Finally, the heavy lined carpeting hich was present throughout Severance Hall on all aisles, promen- les, and under the seats, has been removed and replaced with an tractive vinyl tile covering of low acoustical absorption. These odifications have made a notable improvement in the quality and tensity of orchestral music in Severance Hall and are highly pproved by the concert audience.

534.842

355. FIRST PRESBYTERIAN CHURCH, STAMFORD, ONNECTICUT. D.L.Klepper.
Acoust. Soc. Amer., Vol. 31, No. 7, 879-82 (July, 1959).

This church is unusual in that the basic architectural shape rovides the desired acoustical environment, requiring no "applied" ound-absorbing material. Hearing conditions are highly satisfac- ry for both speech and music. The reverberation time character- tic is discussed along with the "gain" provided by the pulpit nopy.

534.842

356. ACOUSTICS OF THE FREDRIC R. MANN CONCERT HALL, EL AVIV, ISRAEL. L.L.Beranek.
Acoust. Soc. Amer., Vol. 31, No. 7, 882-92 (July, 1959).

The Fredric R. Mann concert auditorium for an audience of bout 2900 and a volume of 750 000 ft^3 opened on October 2, 1957. his article covers general design objectives, factors influencing reverberation time (the final value of reverberation time at 500-1000 c/s with full occupancy is 1.55 sec), shaping, means for controlling reverberation, echo studies, orchestra enclosure, control of exterior noise, and subjective assessment and recommendations for subsequent changes. The auditorium was designed in accordance with specifications laid down by the Building Committee in September 1951. The design achieved the original objectives. Some changes in the orchestra enclosure and ceiling are desired by the musicians. Acceptance of the hall by audiences has been excellent.

534.843

9357. STATE OF KNOWLEDGE IN THE FIELD OF BUILDING ACOUSTICS. K.Gösele.
Hochfrequenztech. u. ElektAkust., Vol. 67, No. 4-5, 97-105 (Jan., 1959). In German.

A general paper dealing with the propagation of sound through, and the sound-insulation of, floors and walls of buildings. The first part of the paper relates to airborne sound transmitted through single and multiple layered floors and walls — the sound damping being measured over a range of frequencies extending up to 5000 c/s. Various methods of increasing the sound damping are described and experimental curves showing damping as a function of frequency are given. The second part of the paper deals with the sounds of footsteps on floors transmitted through ceilings, and via the connecting walls, to adjacent rooms. Illustrations are given of various designs of multi-layer floors and ceilings, including "floating" floors.

A.B.Wood

534.844

9358. REVERBERATION FORMULA WHICH SEEMS TO BE MORE ACCURATE WITH NONUNIFORM DISTRIBUTION OF ABSORPTION. D.Fitzroy.
J. Acoust. Soc. Amer., Vol. 31, No. 7, 893-7 (July, 1959).

Reverberation measurements, made in rooms where the absorption is nonuniformly distributed, usually vary widely from predictions based on the currently employed formulae. Through extensive tests made in a large number of rooms, where distribution of sound absorption varies widely in uniformity, an empirically derived equation is submitted. Photographs of graphic recorder decay curves, showing contrasts in predicted slopes, seem to confirm the validity of the formula. The recorder curves are from field tests. The data submitted are a small portion of an accumulation of measurements, covering several years, in rooms of widely varying volumes, widely varying boundary ratios, and marked dissimilarity in amounts of absorption and ratios of absorption distribution.

534.844

9359. SABINE REVERBERATION EQUATION AND SOUND POWER CALCULATIONS. R.W.Young.
J. Acoust. Soc. Amer., Vol. 31, No. 7, 912-21 (July, 1959).

Formulae pertaining to the calculation of noise in a room produced by a steady source, the measurement of sound power in a reverberant room, and the calculation of reverberation time are reviewed for their appropriateness to engineering use. It is recalled that the simple Sabine reverberation equation can be used without loss of generality provided one associates with a given sound absorbing material a coefficient which is the negative natural logarithm of the energy reflection coefficient; the name Sabine coefficient is tentatively suggested for this quantity. It is noted further that the coefficient usually obtained from tests in a reverberation room is the Sabine coefficient and not truly the sound energy absorption coefficient. A relation is given, between average sound pressure in a room and the power delivered by a source, that does not require averaging absorption coefficients and which is only slightly dependent upon the mean free path. The "Sabine absorption" $S\bar{a}$ is more nearly correct (and easier to compute) than the room constant, $S\bar{\alpha}/(1-\bar{\alpha})$ both for the sound-pressure-power relationship and reverberation time calculation, where S is the wall area, $\bar{a}$ the average Sabine coefficient, and $\bar{\alpha}$ is the average energy absorption coefficient. For sound power level calculations appropriate graphs are provided, showing dependence of intrinsic acoustic impedance and bulk modulus on temperature and barometric pressure or salinity, for air and water, respectively.

534.845

9360. DEPENDENCE OF SOUND ABSORPTION COEFFICIENT UPON AREA OF ACOUSTIC MATERIALS. K.Sato and M.Koyasu.
J. Acoust. Soc. Amer., Vol. 31, No. 5, 628-9 (May, 1959).

Measurements were made in a reverberation chamber on materials with a wide range of absorption coefficient, and the results correlate closely with those reported by Chrisler (Abstr. 3835 of 1934).

H.D.Parbrook

534.845

9361. TRANSMISSION LOSS OF SOME MASONRY WALLS. B.G.Watters.
J. Acoust. Soc. Amer., Vol. 31, No. 7, 898-911 (July, 1959).

The transmission loss of very large, single, solid walls is given by the "coincidence-effect" theory as presented by Cremer and others. The results of this theory have been compared with data from field measurements on some typical, masonry walls and are found to be in fairly good agreement. The differences which exist are believed to reflect the inapplicability of the theory to finite sized walls and the imperfection of the sound diffusion in the test rooms. An empirical design technique is presented which agrees more closely with typical field results. The hollow masonry block walls which were studied behave much like solid walls with the same surface weight and bending stiffness. Laboratory techniques are described for measuring the physical constants of these and other materials. Tests made on a typical lightweight aggregate masonry block show that the porosity through the block faces does not greatly reduce the transmission loss. However, painting such a block may increase the bending stiffness of the wall and slightly alter the transmission loss.

534.846

9362. ACOUSTOELECTRONIC AUDITORIUM. H.F.Olson.
J. Acoust. Soc. Amer., Vol. 31, No. 7, 872-9 (July, 1959).

The term "acoustoelectronic auditorium" is used to designate an auditorium complex incorporating an integrated design of the room acoustics with the sound reinforcing apparatus. Under these conditions, the acoustic characteristics of the electronic sound system are coordinated and correlated with the acoustics of the enclosure. The features of the acoustoelectronic auditorium are as follows: an enclosure providing a large stage, a low ceiling and a seating capacity of 300; sound reinforcing apparatus consisting of the following features: concealed and fixed stage microphones, concealed and fixed auditorium loudspeakers, and a delay system.

534.85

9363. SYNCHRONIZATION OF MUSIC BY JUXTAPOSITION ON DUAL-CHANNEL TAPES. A.G Pikler.
J. Acoust. Soc. Amer., Vol. 31, No. 6, 812 (June, 1959).

A scheme is indicated whereby the synchronized recording of separate musical parts on separate tape tracks may be accomplished with the use of a conventional dual-track recorder which records or plays back simultaneously with both tracks. Possible applications include the rehabilitation of old records, including the addition of new accompaniments, and the correction of flaws in entire passages in modern musical recording techniques by juxtaposed substitution of a corrected segment played from the second track over the period of the flaw. G.M.Brown

534.85

9364. SOUND RECORDING AND "PUBLICATION" OF ACOUSTICAL RESEARCH. W.H.George.
J. Acoust. Soc. Amer., Vol. 31, No. 7, 1030 (July, 1959).

Sound recording and reproduction has reached a sufficiently advanced stage to justify its use as an aid to research publication in acoustics. Examples are quoted and the advantages discussed. A plea is made for its systematic use and a practical plan is proposed, based on the use of national archives already established in Washington, London, Paris, Rome, and Vienna.

OPTICS . SPECTRA . LUMINESCENCE

535.1 : 538.3

UNIQUENESS CRITERION FOR THE SOLUTIONS OF MAXWELL'S EQUATIONS. See Abstr. 8390

535.13 : 538.566

PROPAGATION OF MUTUAL COHERENCE. See Abstr. 8394

535.135

9365. ON THE MOLECULAR THEORY OF REFLECTION AND REFRACTION OF LIGHT. II. LIGHT INCIDENT ON THE BOUNDARY BETWEEN AN ISOTROPIC MEDIUM AND VACUUM OR ANOTHER ISOTROPIC MEDIUM. TOTAL REFLECTION. B.A.Sotskii and F.I.Fedorov.
Optika i Spektrosk., Vol. 5, No. 1, 57-65 (1958). In Russian. English summary: PB 141047T-6, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

For Pt I see Optika i Spektrosk., Vol. 4, No. 3, 365 (1958). Reflection and refraction are considered as the superposition of electromagnetic waves radiated from the dipoles of the medium. It is shown that under certain conditions the vacuum wave produced may be damped. The results are compared with those of Part I. G.F.Lothian

535.231.2 : 535.372

9366. ON "CANDOLUMINESCENCE" OF CaO AND Al_2O_3. V.A.Sokolov, I.S.Grozina and A.N.Gorban'.
Optika i Spektrosk., Vol. 3, No. 1, 92-4 (July, 1957). In Russian.

CaO and Al_2O_3 emit strongly in flames ("candoluminescence") due to oxidizing and reducing reactions in chemically active regions of the flame. Some workers regard this emission as being of purely thermal origin. To check this the authors obtained spectra of CaO and Al_2O_3 emitting in coal gas flames and spectra of the oxidation of Ca and Al by burning the metals in oxygen in front of a spectrograph slit. The results obtained, together with a comparison of the emission of CaO and Al_2O_3 with that of a black body, establish that "candoluminescence" is of purely thermal character and obeys Kirchhoff's law. The effect has no connection with true luminescenc in the region of temperatures studied (above 600°C). A.Tybulewicz

535.232 : 536.3

9367. SPECTRAL EMISSIVITY OF SOLIDS IN THE INFRARED AT LOW TEMPERATURES. D.Weber.
J. Opt. Soc. Amer., Vol. 49, No. 8, 815-20 (Aug., 1959).

Two methods are developed for measuring low-temperature spectral emissivities in the infrared region. Neither of these has apparently been employed previously. One of them, which is only an approximate method, was followed by measurements of three common alloys. The values of emissivity obtained agree reasonably well with those calculated from the reflectivity data of others for similar materials.

535.232 : 536.3

9368. SPECTRAL EMISSIVITY OF CARBON DIOXIDE FROM 1800-2500 cm^{-1}. G.N.Plass.
J. Opt. Soc. Amer., Vol. 49, No. 8, 821-8 (Aug., 1959).

The spectral emissivity of carbon dioxide from 1800-2500 cm^{-1} is calculated as a function of temperature, pressure, and amount of radiating gas. Careful consideration is given to the choice of a proper model to represent the emission when the overlapping of the spectral lines is taken into account. At elevated temperatures the random Elsasser model should be used since many vibrational bands overlap. The emissivities were calculated from the usual intensity and energy expressions on an electronic computer taking into accou up to 890 000 spectral lines at 2400° K. The electric moment matrix element was evaluated by using the harmonic oscillator approximati to represent the vibrational states. The emission from $C^{13}O_2$ and fr the transitions near 2100 and 1900 cm^{-1} was included in the calculation. The shift of the emission to lower frequencies as the temper ature increases is quantitatively explained. The emission in this frequency region from any flame can readily be obtained from the results given here.

535.24

9369. DIFFERENTIAL LUMINANCE THRESHOLDS IN TELEVISION. P.Billard.
Acta electronica, Vol. 2, No. 1-2, 283-92 (1957-58). In French.

"Physical problems of colour television" Conference paper (se Abstr. 1006 of 1958). Owing to luminance limitations of the television screen it is generally impossible to equate the number of jus noticeable brightness steps in the original and the screen image respectively. In the latter, there are significant deviations from Weber's law particularly in the lower ranges. From the results of original experiments, curves are calculated which permit one to determine the characteristics of "uniform deterioration" ("dégradation uniforme") in luminance reproduction for a variety of conditions. R.A.Weal

535.2

9370. CALCULATION OF LUMINANCE IN A COLOUR TELEVISION RECEIVER. S.V.Novakovsky.
Acta electronica, Vol. 2, No. 1-2, 307-15 (1957-58). In French.

"Physical problems of colour television" Conference paper (se Abstr. 1006 of 1958). Expressions are derived for the working conditions of colour television screens in three sets of circumstanc (1) three types of phosphor on one screen; (2) indirect and (3) direc superposition of three images by means of dichroic or achromatic mirrors. R.A.Weal

535.247.4
371. SIMPLE ULTRAVIOLET PHOTOMETER.
.E.Thiers, M.Margoshes and B.L.Vallee.
nalyt. Chem., Vol. 31, No. 7, 1258-61 (July, 1959).

A simple photometer for use in the near-ultraviolet region is escribed, and considerations of its design and performance are iscussed. A monochromatic beam of light with wavelength maximum t 355 mμ and a half-band width of 40 mμ is obtained from a commerial fluorescent lamp. Photovoltaic cells are used as detectors, to perate a direct current microammeter. The instrument, because of s small size and sturdy, simple construction, is well suited to outine work.

535.31
372. LINEARIZING SKEW RAY-TRACING FORMULAE (II).
.Marx.
ptica Acta, Vol. 5, No. 3-4, 65-70 (Sept.-Dec., 1958). In German.

Discussion of the orders of approximation of successive steps a iterative ray-tracing methods. W.T.Welford

535.313.2
373. GENERAL METHOD FOR DETERMINING THE CAUSTIC OR A CATOPTRIC SYSTEM WITH ONE SURFACE OF REVOLUION. K.Stiegler.
ptik, Vol. 15, No. 5, 278-80 (May, 1958). In German.

The general equations of the caustic are given in parametric orm, the equation of its meridian curve being assumed as known.

535.313.2
374. DETERMINATION OF THE SURFACE OF REVOLUTION F A CATOPTRIC SYSTEM FROM GIVEN EQUATIONS OF THE AUSTIC. K.Stiegler.
ptik, Vol. 16, No. 4, 245-8 (April, 1959). In German.

From the equations given in the preceding abstract, the differntial equation for the unknown meridian curve is deduced. This eneral differential equation is applied to a simple case where the iven caustic is degenerated into one single point. The integration s performed with the aid of a Legendre transformation, and the lassical result is obtained that the surface of revolution which orresponds to the given caustic degenerated into one single point s a paraboloid of revolution.

535.317 : 518.5
375. ANALOG FOURIER TRANSFORMER FOR APODISATION TUDIES. N.A.Finkelstein and C.H.Brumley.
. Opt. Soc. Amer., Vol. 49, No. 4, 410 (April, 1959).

A unidimensional analogue computer which obtains the transform f a function presented as a cut-out mask. W.T.Welford

535.317
376. NOTE ON MEASUREMENT OF SINE-WAVE RESPONSE F LENSES. R.E.Stephens.
. Opt. Soc. Amer., Vol. 49, No. 4, 413 (April, 1959).

Improvement of a previous method (Abstr. 4847 of 1958) by hich the sine of the phase angle of the response function can be educed. W.T.Welford

535.317
377. ON THE LOCATION OF THE OPTICAL RESPONSE RIGIN. K.Sayanagi.
. Opt. Soc. Amer., Vol. 49, No. 4, 413-14 (April, 1959).

Suggests that the point corresponding to zero phase shift should ot be taken as the intersection of the principal ray with the image lane, as is usual in theoretical treatments. Since for low frequenies the phase shift tends to zero, the origin should instead be aken as the point to which the maximum in the sinusoidal image attern tends, which is the centre of gravity of the line spreadunction. An experimental method for determining it is suggested. W.T.Welford

535.317
378. ON FOCAL SURFACES WITH A PSEUDO-SPHERICAL ORMAL CONGRUENCE. L. Ya. Berezina.
atv. PSR Zinat. Akad. Vestis, 1958, No. 7(132), 77-80. In Russian.

The conditions for pseudo-spherical normal congruence of focal urfaces are obtained in terms of the trihedral angles of the main ay [there are misprints in equations (1), (2) and (3) where ρ_{1g} and $_{2g}$ should be replaced by S_{1g} and S_{2g} respectively]. Hence, seven heorems pertaining to the geometry of such surfaces are deduced .g. on the centres and radii of curvatures of focal surfaces). J.K.Skwirzynski

535.317.25
9379. RESOLVING POWER OF AN INSTRUMENT WITH A CIRCULAR APERTURE, IN WHITE LIGHT [AND VIEWED BY EYE]. M.S.Sodha.
Optik, Vol. 16, No. 5, 276-9 (May, 1959).

It is found that the resolving power in white light is nearly the same as that calculated by assuming the incidence of a monochromatic radiation for which the eye is most sensitive.

535.317.3
9380. THIN LENS ANALYSIS OF SECONDARY SPECTRUM.
W.J.Smith.
J. Opt. Soc. Amer., Vol. 49, No. 6, 640-1 (June, 1959).

An equation is given for the secondary spectrum of a system of separated thin lenses on the assumption that the system is achromatized in the ordinary sense. Typical values of secondary spectrum are given for some basic types of optical system. W.T.Welford

535.317.4
9381. BOUWERS CONCENTRIC SYSTEMS FOR MATERIALS OF HIGH-REFRACTIVE INDEX. T.J.Lauroesch and C.Wing.
J. Opt. Soc. Amer., Vol. 49, No. 4, 410-11 (April, 1959).

Graphs are presented showing the spherical aberration correction obtainable for menisci of refractive indices 2.0, 2.5 and 3.4. W.T.Welford

535.317.6
9382. FORMULAE FOR REFRACTION THROUGH CYLINDRICAL SURFACES. C.Morais.
Atti. Fond. Ronchi, Vol. 14, No. 3, 255-67 (May-June, 1959).
In Italian.

The trigonometrical verification of the tracing of a sqew ray through a series of cylindrical surfaces having parallel generatrixes is easily derived from the trigonometrical verification of the projection of the ray on a plane perpendicular to the generatrixes.

535.318
9383. TELEVISION ZOOM LENSES. G.H.Cook.
J. Soc. Motion Picture Televis. Engrs, Vol. 68, No. 1, 25-8 (Jan., 1959).

Describes a variable focal length objective in which two components move independently but the movements are connected by a geometrical linkage, not by cams. A movement depending on the same linkage is used for focusing objects at different distances. W.T.Welford

535.32 : 537.311.33

THE DETERMINATION OF THE OPTICAL CONSTANTS OF SEMICONDUCTORS. See Abstr. 8106

535.323 : 535.417
9384. REFRACTIVE INDEX OF URANIUM OXIDE PRODUCED BY ANODIC OXIDATION. A.E.Stebbens and L.L.Shreir.
Nature (London), Vol. 183, 1113-14 (April 18, 1959).

The refractive index of an anodic film, as found by two different interference methods, was 1.93 and 1.95. This is much less than the value of 2.26, determined from Brewster angle measurements for a sintered block of oxide. B.T.M.Willis

535.323
9385. DETERMINATION OF THE OPTICAL CONSTANTS OF METALS IN THE INFRARED REGION.
G.P.Motulevich and A.A.Shubin.
Optika i Spektrosk., Vol. 2, No. 5, 633-6 (May, 1957). In Russian.

The real (n) and imaginary (κ) components of the complex refractive index ($n - i\kappa$) were determined in the 1-6 μ region for Ag, Pb and Sn, by measuring the change in the state of polarization of infrared radiation on reflection at freshly prepared metal surfaces. The conduction electron density for these three metals was calculated from the values of n and κ.

535.323 : 535.345
9386. MEASUREMENT OF THE OPTICAL CONSTANTS OF ANTIMONY IN THE INFRARED SPECTRAL REGION AT TEMPERATURES OF 290° AND 110°K.
I.N.Shklyarevskii, A.A.Avdeenko and V.G.Padalka.
Optika i Spektrosk., Vol. 6, No. 4, 528-32 (April, 1959). In Russian.

The refractive index μ and the absorption index $\mu\chi$ were measured at wavelengths of 1-12 μ and at temperatures of 290° and 110°K, using the technique described by Avery (Abstr. 6371 of 1952), which is essentially a measurement of the ratio R_p/R_s at two angles of incidence (R_p and R_s are the coefficients of reflection for light polarized in the plane of incidence and at right angles to it). From the values of the optical constants, the dependence of the real and imaginary components of permittivity of antimony and its absorption coefficient $A = 4\mu/[(\mu + 1)^2 + (\mu\chi)^2]$ on wavelength was determined. The $A = f(\lambda)$ curves exhibit clear maxima which are due to interband transitions. From the positions of the maxima on the A curves the interband energy gap was calculated. It was found to be 0.18 eV at room temperature and 0.15 eV at 110°K. This compares well with the values of 0.05 to 0.20 eV at room temperature reported by Smith (Abstr. 8424 of 1953). A.Tybulewicz

535.323

9387. THE OPTICAL CONSTANTS OF GERMANIUM IN THE 2-25μ REGION.

M.T.Kostyshin.

Optika i Spektrosk., Vol. 5, No. 3, 312-15 (Sept., 1958). In Russian. English summary : PB141047T-7, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Measurements by a number of authors of refractive index and absorption constant are presented graphically. Two methods of calculating these from experimental data when they are of similar orders of magnitude are discussed. W.T.Welford

535.323

9388. INDEX OF REFRACTION OF NEUTRON IRRADIATED DIAMOND.

J.Pelsmaekers and J.Schepers.

Physica, Vol. 24, No. 10, 838 (Oct., 1958).

No changes in refractive index were detected (to within ±0.0001) in a diamond irradiated by neutrons with an intensity sufficient to turn it green. S.Tolansky

535.325 : 537.56

9389. SOME OBSERVATIONS ON THE EFFECT OF RADIATION ON THE REFRACTIVE INDICES OF CERTAIN GASES.

C.M.Crain.

J. appl. Phys., Vol. 29, No. 11, 1605-6 (Nov., 1958).

Radiation from a nuclear reactor and from a Co^{60} source was passed into a cavity resonator containing, in turn, air, argon, and nitrogen at various pressures, and the free electron density was deduced from the change in refractive index. In the case of air, the refractive index remained constant within 1 in 10^8 for pressures from 100 μ to 1 atm. This indicates a free electron density less than 10^4 electrons per cm^3 for air; assuming that electron loss is due to attachment to the oxygen nucleus, this gives a value of 10^{-19} cm^2 for the attachment cross-section, which does not agree with Biondi [Phys. Rev., Vol. 84, No. 5, 1072 (Dec. 1, 1951)]. In the cases of argon and nitrogen the variation was a few parts in 10^6 as the pressure varied from 2 to 76 cm Hg; this variation was greatly reduced by introduction of atmospheric air, and there is a possibility that use of high purity argon or nitrogen would have led to a greater change in refractive index. N.Corcoran

535.33 : 535.34

9390. ON THE TREATMENT OF SPECTROGRAMS OBTAINED WITH A FABRY–PEROT INTERFEROMETER.

V.K.Ablekov.

Optika i Spektrosk., Vol. 6, No. 4, 562-4 (April, 1959). In Russian.

If $I(\nu)$ is the function which gives the form of a spectral interval and $A(x)$ is the "apparatus function", then the intensity distribution $W(\nu)$ can be written as

$$W(\nu) = \int_{-\infty}^{\infty} I(\nu - x)A(x)dx$$

where ν is the frequency corresponding to one of the maxima in $W(\nu)$. Calculation of the function $I(\nu)$ meets with great mathematical difficulties in many important cases. The present note describes a simple method of determination of the half-width of $I(\nu)$ in the case when a Fabry–Perot interferometer was used and a method of finding the intensity distribution when two spectral intervals are superimposed. A.Tybulewicz

535.33

9391. APPLICATIONS OF INFRARED SPECTROSCOPY TO BIOLOGICAL PROBLEMS.

G.B.B.M.Sutherland.

Rev. mod. Phys., Vol. 31, No. 1, 118-22 (Jan., 1959).

A broad review of the actual and potential contributions of infrared spectroscopy to biology. A short section describes the general interpretation of the i.r spectra of molecules and it is shown how the principles developed can be applied to biology in three ways: (a) as an analytical tool, (b) to determine the structural formula of a compound and (c) to determine the configuration of biological polymers. The study of i.r. spectroscopy of single crystals is urged, particularly of single crystals of simple compounds containing the peptide link. J.Iball

535.33 : 531.25

DISPERSION OF THE STRESS OPTIC COEFFICIENT OF THE ALKALI HALIDES. See Abstr. 9259

535.33.03

9392. INTENSE SCHUMANN–RUNGE SOURCE.

F.Waelbroeck and S.H.Bauer.

J. Opt. Soc. Amer., Vol. 49, No. 1, 102-3 (Jan., 1959).

A high pressure arc source of the Schumann–Runge bands of O_2 has been developed by improving that of Feast (Abstr. 1806 of 1949) by (a) increasing the operating pressure from one to four atmospheres, (b) using heavy Pt electrodes and high currents (200 mA), (c) using a resistor in parallel to the tube. R.W.Nicholls

535.33.03

9393. CONSIDERATIONS OF VACUUM SPARK SOURCES FOR SPECTROCHEMICAL ANALYSIS BY EMISSION IN THE FAR ULTRAVIOLET.

J.Romand and B.Vodar.

J. Phys. Radium, Vol. 19, No. 8-9, 732 (Aug.-Sept., 1958). In French.

The authors discuss the possibility of using vacuum spark sources for spectrochemical analysis with particular reference to the vacuum sliding spark as developed by them. They give some experimental details of this source, and of the spectra obtained. R.D.Hudson

535.33.07

9394. UNAVOIDABLE ERRORS IN THE RECORDING OF SPECTRA.

M.Schubert.

Exper. Tech. der Phys., Vol. 6, No. 5, 203-16 (1958). In German.

If a photocell (or similar detector) scans a spectrum, the amplified output being recorded, errors may arise due to (1) finite width of the exit slit, (2) finite scanning speed in relation to the circuit time-constant, and (3) circuit noise. Expressions for these effects are developed in relation to a spectrum line with Gaussian profile and a continuous spectrum. Conditions for minimum total error are discussed in a general way. G.F.Lothian

535.33.07 : 536.55

9395. DETERMINATION OF RADIAL DENSITY AND TEMPERATURE VARIATIONS IN A VERY HIGH PRESSURE MERCURY LAMP.

H.Burck and Ku Dschi-Yu.

Exper. Tech. der Phys., Vol. 7, No. 1, 39-47 (1959). In German.

Densities are determined by X-ray transmission and the temperatures calculated therefrom. The axial temperature is 6500°K; the results are compared with those of other authors. G.F.Lothian

535.33.07

9396. TORUS GRATING SPECTROMETER.

H.Greiner and E.Schäffer.

Optik, Vol. 16, No. 6, 350-7 (June, 1959). In German.

Calculations are given for the design of a spectrometer having fixed slits and a concave grating of toroidal surface, in which the grating is rotated to vary the wavelength. Conditions are stated to obtain minimum astigmatism, and from these the most favourable ratio of the radii of curvature of the toroidal surface may be derived The gain in radiation intensity through the exit slit, as compared with a spectrometer which uses a spherical grating, is then investigated.

535.33.07

9397. AN EFFECT OF ABERRATIONS OF THE OPTICAL SYSTE OF A MONOCHROMATOR ON ITS RESOLVING POWER.

I.V.Peisakhson.

Optika i Spektrosk., Vol. 4, No. 5, 670-7 (1958). In Russian. English summary : PB141047T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

A generalized definition of effective slit-width of a monochromator as the geometrical slit-width (measured in wave-number unit or otherwise) which in the absence of aberrational and diffraction effects would produce the same energy distribution in the spectrum as in the actual instrument. It is applied to systems using mirrors as collimators and the effect of using the dispersing element at non-minimum deviation is considered. W.T.Welfor

535.33.07 : 536.48

9398. METHODS AND APPARATUS FOR OPTICAL AND SPECTRAL STUDIES AT LOW TEMPERATURES.

V.P.Babenko, V.L.Broude, V.S.Medvedev and A.F.Prikhot'ko.

Pribory i Tekh. Eksper., 1959, No. 1, 115-20 (Jan.-Feb.). In Russia

Describes metal cryostats for optical and spectral studies at emperatures of liquid hydrogen and liquid helium. Using these ryostats very stable temperatures could be obtained with comparatively low consumption of the coolant. The cryostats are uitable for studies of absorption and luminescence of crystals in ree and stressed states and for measurements of crystallo-optical nd photoelectric properties. A.Tybulewicz

535.331

399. DIFFUSE BANDS IN ARC SPECTRA. O.Jefimenko.

. chem. Phys., Vol. 30, No. 4, 1112-13 (April, 1959).

The arc spectra of Al, Ga, In, Tl and Zn electrodes in atmopheres of the noble gases were studied. Diffuse bands characterstic of the respective mixture are observed and attributed to mission during a collision. It is suggested that the bands might e used in spectrochemical analysis. P.Young

535.331

9400. ANALYSIS OF THE SPECTRA OF GADOLINIUM SALTS.

V.A.Runciman.

. chem. Phys., Vol. 30, No. 6, 1632-3 (June, 1959).

Calculations of the Russell–Saunders quartet, sextet, and ctet energy levels of the f^7 configuration have been made, using he hydrogenic approximation but taking into account spin–orbit nteractions. A table of splittings of the lowest excited ^6P state nd of the ^6I state is given. The method employed is that due to Racah. P.Young

535.331

9401. PRELIMINARY CLASSIFICATION OF THE SPECTRUM OF SINGLY IONIZED ERBIUM (Er II).

J.R.McNally, Jr and K.L. Vander Sluis.

. Opt. Soc. Amer., Vol. 49, No. 2, 200 (Feb., 1959).

Data are given for eight new low lying levels of Er II and the discovery of forty higher levels is reported. Two levels, probably from he $4f^{12}6s(^{4,2}F)$ configuration have been located at about 0.6 eV above he lowest level. R.W.Nicholls

535.331

9402. Kr 86 AND Hg 198 WAVELENGTH STANDARDS.

K.M.Baird and D.S.Smith.

Canad. J. Phys., Vol. 37, No. 7, 832-40 (July, 1959).

New values are given for the vacuum wavelengths of six lines Kr^{86} and five lines of Hg^{198} in the visible spectrum. The wavelengths were referred to the Kr^{86} primary standard line, 6057.80211, by a series of very careful measurements over a period of several years. The accuracy with which wavelengths can be compared by present methods is discussed at some length.

535.332

9403. STARK BROADENING FUNCTIONS FOR THE HYDROGEN LINES. A.B.Underhill and J.H.Waddell.

Circ. Nat. Bur. Stand., No. 603, 94 pp. (1959).

Numerical values of the intensities of the Stark components of he hydrogen lines and the Stark broadening functions, $S(\alpha)$, are presented for all series members up to and including n = 18. The $S(\alpha)$ functions are tabulated for lines of the Balmer, Lyman, Paschen, and Brackett series of hydrogen. The data can be used o compute self-consistent profiles of the hydrogen lines in stellar spectra.

535.333

9404. SECOND POSITIVE BANDS IN THE LEWIS–RAYLEIGH AFTERGLOW OF NITROGEN.

Y.Tanaka, F.LeBlanc and A.Jursa.

. chem. Phys., Vol. 30, No. 6, 1624-5 (June, 1959).

The second positive bands of nitrogen have been observed in the Lewis–Rayleigh afterglow cooled with liquid nitrogen. The bands are almost as strong as the first positive bands but their intensity distribution is considerably different from that in an ordinary discharge of N_2, for the bands originating from v′ = 4 are abnormally strong. A brief discussion of the results is given. R.D.Hudson

535.333 : 534.222.2

9405. RADIATION FROM HOT AIR. II. SHOCK TUBE STUDY OF ABSOLUTE INTENSITIES.

J.C.Keck, J.C.Camm, B.Kivel and T.Wentink, Jr.

Ann. Phys. (New York), Vol. 7, No. 1, 1-38 (May, 1959).

For Pt I, see Abstr. 1599 (1958). The radiation emitted by shock-heated oxygen, nitrogen, and air has been studied in the wavelength range 2000 to 10 000 A at temperatures from 4000 to 9000° K and densities from 0.01 to 10 times standard atmospheric. Both spectroscopic and photometric techniques were employed. The radiation consists of bands from O_2, N_2, N_2^+, and NO molecules, lines from O and N atoms and continuum Kramers radiation from O^-. Comparison of the experimental results with the theoretical expressions giving the wavelength, temperature and density dependence of the radiation gave electronic f-numbers for all the bands observed.

535.333

9406. SOME OBSERVATIONS ON THE SPECTRA OF THE DIATOMIC FLUORIDES OF SILICON, GERMANIUM, TIN AND LEAD.

R.F.Barrow, D.Butler, J.W.C.Johns and J.L.Powell.

Proc. Phys. Soc., Vol. 73, Pt 2, 317-20 (Feb., 1959).

Rotational analyses of the ϵ bands of SiF $(C^1, D^1\ ^2\Pi - A\ ^2\Sigma^+)$ are reported (cf. Abstr. 1603 of 1958). Vibrational analyses of six new ultraviolet systems of GeF have been carried out, and modified analyses are given for SnF. Observations on the A–X system of PbF in emission show that state A is probably $^2\Sigma^+$ and not $^2\Delta$. R.F.Barrow

535.333

9407. THE C–X SYSTEM OF N_2^+. P.K.Carroll.

Canad. J. Phys., Vol. 37, No. 7, 880-9 (July, 1959).

The $C\ ^2\Sigma_u^+ - X\ ^2\Sigma_g^+$ system of N_2^+ was investigated under high resolution in the region 1650-2000 A. Fifteen bands of the system were analysed and accurate rotational constants and other data for the $C\ ^2\Sigma_u^+$ state were derived. Anomalies in the rotational and vibrational structure are discussed. Some evidence in favour of a predissociation between the levels v = 2 and v = 3 of the $C\ ^2\Sigma_u^+$ state is presented.

535.333

9408. NEW BAND SYSTEMS OF FeBr IN THE VISIBLE REGION.

S.P.Reddy.

J. sci. industr. Res., Vol. 18B, No. 5, 188-90 (May, 1959).

Four band systems attributed to the FeBr molecule have been observed in the region 5720-6410 A, when excited both in a high frequency discharge and in a heavy current discharge from a generator. Starting from the shorter wavelength side these are designated as systems I, II, III and IV. In each of the first three band systems, only two sequences have been identified while in the fourth, three sequences have been observed. The vibrational analyses of the four systems indicate that systems I, II and IV have a common lower state which may probably be the ground state of the FeBr molecule. Systems I and II, which consist of single headed bands, may belong to a transition of the type Σ–Σ with multiplicity 2 or 4. The bands of systems III and IV show P and Q heads. In the O,O band of system IV, the O "form" head is identified in addition to the P and Q heads. Each of the systems III and IV may probably belong to a transition of the type Π–Σ with multiplicity 2 or 4.

535.333

9409. FAR INFRARED SPECTRA OF H_2O AND H_2S TAKEN WITH AN INTERFEROMETRIC SPECTROGRAPH.

G.A. Vanasse, J.Strong and E.Loewenstein.

J. Opt. Soc. Amer., Vol. 49, No. 3, 309-10 (March, 1959).

Describes the construction of a large 12 in. aperture instrument using principles described in Abstr. 226 (1957). Shows spectrograms of H_2O (10-50 cm^{-1}) and H_2S (30-70 cm^{-1}). G.F.Lothian

535.333 : 541.124

RESOLVED INFRARED EMISSION SPECTRUM OF THE REACTION ATOMIC H· PLUS Cl_2. See Abstr. 8949

535.34 : 523.164.43

9410. THE CONTINUOUS ABSORPTION COEFFICIENT FOR FREE–FREE EMISSION IN THE RADIOFREQUENCY SPECTRAL REGION. L.Oster.

Z. Astrophys., Vol. 47, No. 3, 169-90 (1959). In German.

The theory of free–free emission is critically investigated. The reasons for the differences in the numerical results which arise when the absorption coefficient is derived directly instead of the emission coefficient, and when use is made of classical instead of quantum mechanical formulae, are explained. For practical use in astrophysics and experimental work, an expression is given covering the entire range of interest of temperature, density and frequency.

535.34.07

9411. MICROGAS CELL FOR INFRARED SPECTROSCOPY.

J.U.White, N.L.Alpert, W.M.Ward and W.S.Gallaway.

Analyt. Chem., Vol. 31, No. 7, 1267-70 (July, 1959).

A cell has been built for measuring the spectra of very small gas samples. Its path length is 1 m, its volume 22ml, and the transmittance through it and the beam condenser used with it is 30%. It has been used in conjunction with a Beckman IR-5 infrared spectrophotometer to observe the spectra of gas chromatograph fractions less than 0.05% of the total charge.

535.34.07

9412. A MICRO SPECTROPHOTOMETER FOR THE ULTRA-VIOLET AND THE VISIBLE REGIONS.
A.Catino, A.Ceruti and P.Colombino.
Atti Accad. Sci. Torino I, Vol. 93, No. 1, 39-61 (1958-59). In Italian.

The apparatus consists essentially of a monochromator, two reflecting microscope objectives and a photomultiplier as a receiver. Under favourable conditions, absorptions of cells about 1 μ in diameter can be determined. Full details of the equipment are given and sample results are quoted. R.W.Fish

535.34.07

9413. RESOLVING POWER OF INSTRUMENTS EXAMINING ABSORPTION SPECTRA. S.S.Mitra and M.S.Sodha.
Optik, Vol. 14, No. 6, 277-81 (June, 1957).

Tables and graphs are given for the variation of resolving power with the fraction of white light intensity absorbed by the absorption cell in the case of a prism, grating, Fabry—Perot etalon, and reflecting echelon, and when the instrumental width is negligible.

535.34.07

9414. ON THE OPTIMUM OPTICAL DENSITY IN ABSORPTION ANALYSIS OF GAS OR LIQUID MIXTURES. A.O.Sall'.
Optika i Spektrosk., Vol. 5, No. 3, 316-21 (Sept., 1958). In Russian. English summary: PB 141047T-7, obtainable from Office of Technical Services, U.S.Dept. of Commerce, Washington, D.C., U.S.A.

Approximate formulae are given for the optimum optical density of a mixture to be analysed, depending on the wavelengths to be used and the method of measurement. The following methods are discussed: (1) double beam differential absorptiometry, (2) use of a mixture of known composition and variable thickness for balancing, (3) as (2) but with constant thickness and variable concentration of the mixture, and (4) a single sample chamber with a vibrating mirror to vary the thickness. W.T.Welford

535.34.07

9415. AN APPARATUS FOR MICROSPECTROPHOTOMETRY USING A SPECTROPHOTOMETER. K.H.Brauer and F.Fröhlich.
Exper. Tech. der Phys., Vol. 6, No. 5, 216-22 (1958). In German.

An attachment to a spectrophotometer is described in detail. This allows absorption measurements to be made on small objects and in particular the variation of absorption with position of an extended body to be measured. Using a Zeiss spectrophotometer, a wavelength range of 250-1100 mμ can be examined. Typical results are given. R.W.Fish

535.341

9416. ON MEASUREMENT OF THE INTENSITY OF STRONG ABSORPTION BANDS IN THE INFRARED SPECTRA OF LIQUIDS. G.S.Denisov.
Optika i Spektrosk., Vol. 6, No. 4, 475-7 (April, 1959). In Russian.

Investigations of the intensity of the infrared absorption spectra of some liquids are difficult or impossible because of their very high coefficients of absorption. To study bands with very high absorption it is necessary to use layers 1-5 μ thick. The present paper describes the construction of cells made of highly polished rock salt plates 1-5 μ apart. Possible errors due to selective absorption are discussed. A.Tybulewicz

535.343 : 541.182.6

PARTICLE SIZE AND CONCENTRATION FROM SPECTROPHOTOMETRIC TRANSMISSION. See Abstr. 8974

535.343 : 539.19

ABSORPTION SPECTRUM OF TRAPPED NH_2 RADICALS AT 4.2°K. See Abstr. 8719

535.343 : 539.19

THE ELECTRONIC SPECTRA OF PORPHINE. See Abstr. 8726

535.343

9417. ABSORPTION SPECTRUM OF VIBRATIONALLY EXCITED N_2 IN ACTIVE NITROGEN. K.Dressler.
J. chem. Phys., Vol. 30, No. 6, 1621-2 (June, 1959).

The vacuum ultraviolet absorption spectrum of active nitrogen has been investigated and bands due to vibrationally excited ground state nitrogen have been positively identified. It is estimated that the concentration of the excited molecule is considerably greater than 10%. R.D.Hudson

535.343

9418. ABSORPTION SPECTRA AT 4°K OF SINGLE CRYSTALS OF NORMAL AND ISOTOPICALLY SUBSTITUTED SODIUM AND POTASSIUM NITRATES. E.V.Sayre.
J. chem. Phys., Vol. 31, No. 1, 73-80 (July, 1959).

Sharp line structure is observed in the low energy shoulder of the 3000 A absorption band of crystalline nitrates that have been cooled to 4°K. Single crystals of normal and of N^{15} isotopically substituted sodium and potassium nitrates were examined spectrographically. Correlation between the spacings, polarization and orientation properties, isotope effect, and crystal field splitting of the spectra permitted their analysis. In terms of the D_{3h} point symmetry of a free nitrate ion the excited electronic state is E'. This electronic configuration is one of three considered likely upon the basis of a LCAO molecular orbital treatment of the ion. The two asymmetric E' vibrations of the ion predominantly contribute to the band structure. A large Frank—Condon shift, an extensive weakening of force constants, and the character of the excited vibrations indicate that the excited ion is planar but expanded with perhaps some, but not a great amount, of asymmetric distortion. Predissociation appears at a level corresponding to a dissociation energy of 3.76 eV for the nitrate ion.

535.343 : 535.37

9419. ABSORPTION AND LUMINESCENCE OF STILBENE IMPURITY IN DIBENZYL CRYSTALS AT 20.4°K.
A.F.Prikhot'ko and M.T.Shpak.
Optika i Spektrosk., Vol. 4, No. 1, 17-29 (Jan., 1958). In Russian. English summary: PB141047T-3, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The absorption bands of strongly absorbing crystals (e.g., stilbene and tolane) are still comparatively wide at liquid-hydrogen temperatures. When the absorbing molecules are separated by molecules of a host lattice, the impurity absorption bands are sufficiently narrow to be called lines. Crystals with such impuritie usually luminesce. This paper deals with absorption and luminescence spectra of stilbene in dibenzyl crystals at 20.4°K. Crystal thicknesses for absorption studies were from tens of mμ to 160 mμ for luminescence 1 mm, and the stilbene content was from 0.001% to 3-5% by weight. Analysis of the spectra yields the main absorption series due to intra-molecular vibrations, beginning at 29904 cn with wave-number differences: 208, 297, 402, 590, 745, 847, 978, 1249, 1333, 1427, 1538 and 1593 cm^{-1}, with each of these, except 40 and 590 cm^{-1} the beginning of a further series. There is also a second weaker series beginning at 29840 cm^{-1}. Comparison of the absorption and luminescence spectra shows that certain lines are either identical or very close to one another in both spectra. J.B.Birk

535.343 : 535.37

9420. ABSORPTION AND LUMINESCENCE OF STILBENE IMPURITY IN TOLANE CRYSTALS AT 20.4°K.
A.F.Prikhot'ko and M.T.Shpak.
Optika i Spektrosk., Vol. 4, No. 1, 30-9 (Jan., 1958). In Russian. English summary: PB141047T-3, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Similar work to previous abstract, using tolane as the host lattice crystal. The most important difference is in the polarizatic of certain absorption bands of stilbene in tolane which are rather similar to the absorption bands of tolane itself. The impurity lines are found to be strongly polarized; each new transition to a deform or differently oriented molecule could depress the remaining transitions and become the beginning of all series. The absorption band remain narrow and sharp, although they are broadened on increasi the stilbene concentration. In the luminescence spectra, if the thre series beginning at 29672, 29528 and 29468 cm^{-1} are separated out then the intramolecular vibrational frequencies of stilbene in tolan are close to the corresponding frequencies from the Raman spectr and from the luminescence spectrum of stilbene in dibenzyl. Stilb and tolane form a continuous series of solid solutions, since their lattices are practically identical. Introduction of stilbene molecul into lattice sites produces "defects" which form absorption centre The authors note that tolane itself does not luminesce, but luminescence occurs only from the impurity levels. A comparison is mad with stoichiometric effects in CdS. J.B.Birk

535.3

9421. THE VIBRATIONAL NUMBERING OF THE $A^2\Pi - X^2\Sigma$ BANDS OF N_2^+. I.D.Liu.
Astrophys. J., Vol. 129, No. 2, 516-17 (March, 1959).

The isotope shift in the $^{15}N^+$ bands relative to the $^{14}N^+$ bands measured and confirms the vibrational numbering of the $A^2\Pi$ ate revised by Meinel (Abstr. 3450 of 1952). The ambiguity in is assignment is thus removed. R.W.Nicholls

535.343

422. NEW VISIBLE BAND SYSTEMS OF THE PO MOLECULE.

.Kanaka Durga and P.Tiruvenganna Rao.

dian J. Phys., Vol. 32, No. 5, 223-9 (May, 1958).

Two new band systems have been observed in the visible egion in a high frequency discharge, when moist red phosphorus excited under low pressure conditions. Of the four new groups bands observed, two are assigned to one system designated as –B while the other two groups are assigned to another system esignated as D'–B. The common lower state B is identified as e upper state of B–X ultraviolet system of PO. The D level is entified as the upper state of the D–X system of PO having a oublet separation of 27 K. The structure of the two systems seem indicate $^{2}\Delta_{a}-{}^{2}\Pi_{b}$ and $^{2}\Delta_{a}-{}^{2}\Pi_{b}$ transitions for the systems D'–B nd D–B systems respectively, the upper states being different. he D' level has a doublet separation of 97 K. The electronic ates of PO and related molecules are discussed in terms of ectron configurations.

535.343

423. THE BAND SPECTRUM OF THALLIUM DEUTERIDE.

.Neuhaus and V.Muld.

. Phys., Vol. 153, No. 4, 412-22 (1959). In German.

The band system at 5500 A, observed with high resolution in bsorption is assigned to a $^{3}\pi_{0}-X^{1}\Sigma^{+}$ transition. The wave-numbers the separate lines are tabulated. The absence of hyperfine ructure is discussed in relation to the predissociation broadening some parts of the system. G.F.Lothian

535.343

424. ON THE BAND SPECTRA OF GALLIUM HYDRIDE AND EUTERIDE.

H.Neuhaus.

rk. Fys., Vol. 14, Paper 34, 551-6 (1959). In German.

The bands in the yellow region for the transitions $^{3}\pi_{1}-X^{1}\Sigma^{+}$ nd $^{3}\pi_{0}-X^{1}\Sigma^{+}$ are observed in both emission and absorption with pparatus described in the preceding abstract. Wave-numbers are bulated for P, Q and R branches and rotational constants for the erms are calculated. The diffuse absorption continuum of GaH in e violet is attributed to a $^{1}\pi-X^{1}\Sigma^{+}$ transition. G.F.Lothian

535.343

425. THE ABSORPTION SPECTRA OF COBALT COMPOUNDS.

.V.Grum-Grzhimailo and I.I.Plyusnina.

ristallografiya, Vol. 3, No. 2, 175-81 (1958). In Russian.

Curves of absorption against wavelength from 300 to 1100 mμ re given for solutions of $Co(SCN)_2.6H_2O$; $CoSO_4.7H_2O$; $CoCl_2.6H_2O$; r powdered Cs_2CoCl_4, Cs_2CoBr_4, and $CoCl_2.nH_2O$, where n may e 0, 2 or 6; for a crystalline plate of $CoCl_2.6H_2O$; for a silicate lass coloured with Co; and for various complex Co-NH_4 compounds. the latter case, the wavelength of maximum absorption is tabuted. The results are discussed in terms of the structure and oordination of the compounds. R.F.S.Hearmon

535.343

426. ON THE ORIGIN OF THE SPECTRUM OF LIQUID AND OMPRESSED OXYGEN (12 600-3000 A).

V.I.Dianov-Klokov.

ptika i Spektrosk., Vol. 6, No. 4, 457-62 (April, 1959). In Russian.

To explain the origin of the absorption spectrum of condensed xygen in the region 12 600-3000 A it is necessary to decide whether e spectrum is due to a pair of interacting molecules $(O_2)_2$ or to one olecule O_2. To answer this question, the author investigated the mperature and density dependences of the intensity of absorption ands of condensed oxygen. The results obtained agree with the ssumption that the absorption spectrum of condensed oxygen in the egion 12 600-3000 A is almost entirely due to the dipole transitions "statistical" complexes $(O_2)_2$. A.Tybulewicz

535.343 : 541.135

SPECTROPHOTOMETRIC DETERMINATION OF THE ELEC-RON AFFINITY OF FLUORINE. See Abstr. 8961

535.343 : 535.337

427. ZEEMAN EFFECT OF ANISOTROPIC CENTRES IN THE UBIC CRYSTAL LATTICE.

.A.Arkhangel'skaya and P.P.Feofilov.

ptika i Spektrosk., Vol. 4, No. 5, 602-19 (1958). In Russian. nglish summary: PB141047T-2, obtainable from Office of Techical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The magnetic splitting of lines of anisotropic rare earth ions single crystals of CaF_2 was observed at the temperature of liquid N_2 in absorption and fluorescence. Theoretical considerations show how the observations permit deductions of the orientations of the centres with respect to the crystal axes, as well as their structure and energy levels. Results indicate that the centres are oriented along a triad crystal axis. Anomalous results were obtained with Sm, Ho, and Er. G.F.Lothian

535.343

9428. THE ABSORPTION SPECTRUM OF ZnS MONOCRYSTALS.

M.N.Alentsev and E.I.Panasyuk.

Optika i Spektrosk., Vol. 5, No. 2, 207-8 (1958). In Russian. English summary: PB 141047T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Crystals 2 cm × 1 mm × 1-10 μ thick were made by reaction of Zn vapour with H_2S above 1000°C. They had high dark resistance and were non-luminescent. Above 3500 A all crystals had the same transmission, from which the refractive index was calculated as 2.6 at 3500 A and 2.3 at 6000 A. Between 3500 and 3130 A the absorption coefficient was determined. S.T.Henderson

535.343

9429. ABSORPTION SPECTRA OF CRYSTALS OF CERTAIN GALLIUM CHALCOGENIDES.

E.F.Gross, B.V.Novikov, B.S.Razbirin and L.G.Suslina.

Optika i Spektrosk., Vol. 6, No. 4, 569-72 (April, 1959). In Russian.

Reports an investigation of the absorption spectra of GaS and GaSe crystals with hexagonal laminar structures and of β-Ga_2S_3 and Ga_2Se_3 crystals. Structure in the fundamental absorption edge (due to excitons) was observed in the spectra of GaS and GaSe at 77°K (these edges were at the blue end of the visible spectrum). Such structure was also visible in the absorption spectrum of GaSe at room temperature. In contrast to GaS and GaSe, no structure was observed in the fundamental absorption edges of β-Ga_2S_3 and Ga_2Se_3 either at room temperature or at 77°K. The absence of structure in the absorption spectra of β-Ga_2S_3 and Ga_2Se_3 is probably due to a large number of randomly distributed imperfections in these crystals. Such imperfections impede formation and migration of excitons and consequently the exciton lifetime is very short. Under such conditions the exciton structure of the absorption bands may be very diffuse or it may disappear altogether. From the absorption spectra the authors deduced the energy gaps in these semiconductors. A.Tybulewicz

535.343 : 541.14

OPTICAL ABSORPTION STUDIES OF THE VOLUME PHOTOLYSIS OF LARGE SILVER CHLORIDE CRYSTALS. See Abstr. 8966

535.343

9430. PRESSURE INDUCED SHIFTS OF HCl ABSORPTION LINES IN THE INFRARED.

S.Kimel, M.A.Hirshfeld and J.H.Jaffe.

J. chem. Phys., Vol. 31, No. 1, 81-4 (July, 1959).

Pressure induced shifts of the individual lines of the HCl 2-0 band at 1.76 μ were measured over a range of pressures below atmospheric. A strong dependence of the shift on the rotational quantum numbers was found. For self-shifts the lines near the band centre were shifted toward the blue and others toward the red. The results are discussed qualitatively. Measurements on shifts due to the addition of a foreign gas are also reported.

535.343

9431. CALCULATION OF THE INTENSITY OF BANDS INDUCED BY PRESSURE IN MIXTURES OF POLAR GASES. EFFECT OF QUADRUPOLE MOMENTS AND DISPERSION FORCES.

L.Galatry.

J. Phys. Radium, Vol. 19, No. 10, 796 (Oct., 1958). In French.

Absorption coefficients of the fundamental frequency (A_1) of the non-polar gas and of the combination frequency (A_{12}), in mixtures of HCl and HBr with H_2, have been calculated by a method previously published (Abstr. 5313 of 1955). The quadrupole moment contributes about a quarter and the orientation effect about one-twentieth to the result. R.C.Seymour

535.343

9432. INFRARED DISPERSION DUE TO THE ASYMMETRIC STRETCHING VIBRATION OF CS_2.

E.E.Ferguson and R.E.Kagarise.

J. chem. Phys., Vol. 31, No. 1, 236-8 (July, 1959).

Infrared dispersion data on liquid CS_2 in the wavelength range 2-15 μ have been analysed according to classical dispersion theory to yield both gas and liquid oscillator strengths for the asymmetric stretching vibration. The calculated gas intensity for this vibration is 7000×10^{10} cm^{-1} sec^{-1} (STP) as compared with directly measured values around 7500×10^{10}. The intensity of the bending vibration of CS_2 which has not yet been measured is inferred to be 275×10^{10}

cm^{-1} sec^{-1}. The CS bond dipole moment is calculated to be 1.24 Debye which gives a quadrupole moment in reasonable agreement with experiment.

535.343

9433. VIBRATION—ROTATION BANDS OF HYDROGEN AND DEUTERIUM SELENIDE. E.D.Palik.
J. molecular Spectrosc., Vol. 3, No. 3, 259-95 (June, 1959).

The infrared fundamental vibration—rotation bands have been measured with a vacuum prism-grating spectrograph with spectral slit widths of about 0.2 cm^{-1}. Using ground state energy levels obtained from far infrared pure rotational data, the bands have been analysed to obtain rotational constants for the various excited vibrational states.

535.343 : 536.423.15

INFRARED SPECTRUM OF HEXABORANE. See Abstr. 8038

535.343 : 535.337 : 539.19

9434. THE STARK EFFECT IN THE ROTATIONAL SPECTRA OF ASYMMETRICAL-TOP MOLECULES IN THE PRESENCE OF A QUADRUPOLE BOND (THE $\mu\epsilon \approx eQq$ CASE).
E.M.Zemskov and V.G.Veselago.
Optika i Spektrosk., Vol. 3, No. 2, 183-6 (Aug., 1957). In Russian.

The Stark splitting is used to study the rotational spectra of asymmetrical-top molecules. If such a molecule contains an atom whose nucleus possesses a quadrupole moment the rotational spectrum becomes very complex. A recent theory of the simultaneous Stark and quadrupole interaction in rotational spectra dealt only with the case when one of these interactions is much larger than the other. The present paper deals with the case when both these interactions are of the same order, i.e., $\mu\epsilon \approx eQq$.
A.Tybulewicz

535.343

9435. STUDY OF THE INFRARED SPECTRUM IN THE REGION OF 3μ OF VARIOUS SAMPLES OF CLEAR QUARTZ AND OF QUARTZ IRRADIATED WITH NEUTRONS.
A.Hadni, L.Taurel, M.Paillette and A.Lankoande.
C.R. Acad. Sci. (Paris), Vol. 248, No. 2, 211-13 (Jan. 12, 1959). In French.

The fine structure of the absorption band between 2.7 and 3.4 μ is described. It varies according to the origin of the sample and the degree of irradiation, and is attributed to impurities or lattice defects.
B.T.M.Willis

535.343

9436. INFRARED SPECTRA OF THE FROZEN OXIDES OF NITROGEN. W.G.Fateley, H.A.Bent and B.Crawford,Jr.
J. chem. Phys., Vol. 31, No. 1, 204-17 (July, 1959).

Infrared studies have been made of several oxides of nitrogen trapped at liquid-helium temperatures in matrices of argon, N_2, O_2, CO_2, H_2, and N_2O. The novel techniques permitting these studies are described. NO is found as the monomer and two forms of dimer, "cis" and "trans"; the cis is more stable. NO_2 is found as the monomer, the known stable dimer of planar structure, and two new dimers; one of these has the $ONO-NO_2$ structure, and the other may be the twisted V_d form of the stable dimer. N_2O_3 is found in its stable form $ON-NO_2$ and in a second form whose spectrum is consistent with the structure ONONO. Observations on covalent N_2O_5 are also reported.

535.343

9437. INVESTIGATION OF THE ABSORPTION OF ARTIFICIALLY GROWN LiF CRYSTALS IN THE NEAR INFRARED.
A.Deubner, G.Schreiber and R.Schubert.
Optik, Vol. 15, No. 12, 734-8 (Dec., 1958). In German.

The crystals show an absorption band near 2.8 μ with an intensity which varies strongly with the nature of the crystal. It is shown that this band must be due to oscillations of the OH valency band.

535.343 : 539.213

9438. THE TRANSMISSION SPECTRA OF QUARTZ GLASS IN THE REGION 2-24 μ. N.A.Sevchenko and V.A.Florinskaya.
Optika i Spektrosk., Vol. 5, No. 1, 23-8 (1958). In Russian. English summary: PB 141047T-6, obtainable from Office of Technical Services, U.S.Dept. of Commerce, Washington, D.C., U.S.A.

The structure of vitreous silica was studied through the change of its infrared spectrum in the process of transition from the crystalline to the glassy state. Quartz glasses were obtained by melting Brazilian quartz over the temperatures 1720-1740, 1750-1800, 1800, 1850, 1900°C. The spectra were found to be complex because of the incompleteness of destruction of the quartz lattice on melting.
R.W.Nicholls

535.343 : 537.311.33

PREPARATION AND PROPERTIES OF HgTe AND MIXED CRYSTALS OF HgTe—CdTe. See Abstr. 8104

535.343 : 539.2

HOLE-ZONE STRUCTURE OF Te. INFRARED ABSORPTION. See Abstr. 8861

535.343 : 539.19

INFRARED SPECTRA OF FORMIC ACID. See Abstr. 8715

535.343

9439. MICROWAVE SPECTRUM, STRUCTURE, AND INTERNAL ROTATION OF DIMETHYL ETHER. P.H.Kasai and R.J.Myers.
J. chem. Phys., Vol. 30, No. 4, 1096-7 (April, 1959).

Microwave study of $(CH_3)_2O$ and $(CD_3)_2O$ determined the rotational constants, hence the structure, which is in good agreement with that obtained by electron diffraction study in Abstr. 3990 of 1959. The internal barrier is found to be 2.72 kcal/mole. A splitting in the torsional spectrum is ascribed to potential energy coupling between the methyl groups, and could be used to study this.
J.Hawgood

535.343.9 : 535.375.5

9440. RAMAN SPECTRUM OF ANTIMONY TRICHLORIDE CRYSTALS. A.Tramer.
Bull. Acad. Polon. Sci. Ser. Sci. math. astron. phys., Vol. 6, No. 10, 659-61 (1958).

The spectrum shows frequencies similar to those of the liquid, but with some splitting of the two degenerate frequencies. In addition there are 9 weak lines of low frequency attributed to lattice vibrations.
G.F.Lothian

535.343.9 : 535.375.5

9441. RAMAN SCATTERING OF LIGHT BY SOLUTIONS IN THE ABSORPTION-BAND REGION. L.N Ovander.
Optika i Spektrosk., Vol. 4, No. 5, 555-9 (1958). In Russian. English summary: PB141047T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

A theoretical discussion of the intensity, structure and temperature dependence of Raman spectra, based on a model given in previous papers. See Abstr. 7313 (1953), 970 (1958); Optika i Spektrosk., Vol. 3, No. 3, 221 (1957).
G.F.Lothian

535.343.9 : 535.375.5

9442. RAMAN SPECTRA OF H_2 AND CH_4 AT HIGH PRESSURES. A.D.May, J.C.Stryland and H.L.Welsh.
J. chem. Phys., Vol. 30, No. 4, 1099-100 (April, 1959).

The vibrational line of H_2 and the ν_1 vibration of CH_4 at 2000 atm are shifted a little from their positions at 1 atm, but are considerably removed from the lines of liquid and solid at similar densities. Rotational lines of H_2 do not show these latter differences.
G.F.Lothian

535.343.9 : 535.375.5

9443. LINE INTENSITIES IN THE RAMAN EFFECT OF $^1\Sigma$ DIATOMIC MOLECULES. T.C.James and W.Klemperer.
J. chem. Phys., Vol. 31, No. 1, 130-4 (July, 1959).

The effect of rotation—vibration interactions on line intensities in the Raman effect is examined. Both the rotation—vibration and pure rotation spectra are discussed. It is shown that from a study of relative line intensities one can obtain the quantities $\beta_0/\beta_1 r_e$ and κ_1^2/β_1^2, where β_0 and β_1 are the first two terms in the expansion of the anisotropy of the polarizability about the equilibrium internuclear distance r_e, and κ_1 is the derivative with respect to internuclear distance of the spherical part of the polarizability. The treatment considers only the case of a harmonic oscillator and is carried through to terms of order γ^2, where $\gamma = 2B_e/\omega_e$.

535.343.9 : 535.375.

9444. THE RAMAN SPECTRA OF CERTAIN GERMANIUM GLASSES. Ya.S.Bobovich and T.P.Tulub.
Optika i Spektrosk., Vol. 5, No. 2, 210-13 (1958). In Russian. English summary: PB 141047T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Polarized or unpolarized light (4358 A) was used. Diagrams show the state of polarization of the Raman spectra in glassy GeO_2, and compare the spectra of SiO_2 and GeO_2, and of $Na_2O.2SiO_2$ and $Na_2O.2GeO_2$. Structural similarity is thus indicated in each pair, nd confirmed by calculation. By comparison of $2Na_2O.GeO_2.2SiO_2$ with . two-component silicate glass it appears that Na_2O is distributed qually between SiO_2 and GeO_2. S.T.Henderson

535.343.9 : 535.375.5

445. TEMPERATURE DEPENDENCE OF INTENSITIES OF TOKES' BANDS IN THE RAMAN SPECTRA OF CERTAIN SOLIDS. a.S.Bobovich and T.P.Tulub.
ptika i Spektrosk., Vol. 6, No. 4, 566-9 (April, 1959). In Russian.

Due to inherent experimental difficulties, studies of the tempera ure dependence of the Raman band intensities in solids reported so ar have been inconclusive. The authors studied this dependence at 00°-500° K in crystalline and fused quartz, Iceland spar and two lasses (silicate glass with 24 mol.% Na_2O and 76 mol.% of SiO_2 nd borate glass with 20 mol.% of BaO and 80 mol.% B_2O_3). The aman band intensities in the spectra of crystalline and fused uartz and the two glasses were found to rise with temperature in greement with theory. In some cases the rise sould not be observed ecause it was of the same order as the experimental error. celand spar was the only substance which exhibited anomalous emperature dependence of the Raman band intensity. The anomaly onsisted of a 30% fall in the intensity of a 1085 cm^{-1} band on ncrease of temperature from 300° to 500° K. A.Tybulewicz

535.345 : 539.21

446. OPTICAL ABSORPTION OF $PbCl_2$ WITH A TOICHIOMETRIC EXCESS OF METAL OR HALOGEN. .M.Gudris and I.N.Shul'ts.
ptika i Spektrosk., Vol. 3, No. 3, 246-50 (Sept., 1957). In Russian.

Films of $PbCl_2$, not thicker than 0.5μ, were produced by vacuum eposition on a quartz base. Their absorption spectra were measured n the region of the fundamental absorption band (λ_{max} = 273 mμ). The films were heated in vapours of lead, mercury, cadmium, tin, odium and chlorine (additive coloration). The excess of lead or resence of one of the other metals produced additional absorption. With increase of temperature the intensities of the additional absorption ands decreased but the positions of their maxima were not affected. The absorption spectra of $PbCl_2$ films with an excess of chlorine had wo new bands at 279 and 282 mμ. Again an increase of temperature lid not destroy the new absorption bands but simply decreased their ntensities. When the films were irradiated with X-rays (photo-hemical coloration) at 20°C all the absorption bands produced by arious metals or chlorine were observed. The bands obtained using -rays were less stable and heating to 200°C destroyed them. The uthors conclude that the absorption centres responsible for the dditional bands are of electron and hole type. A.Tybulewicz

535.345 : 537.311.32

447. OPTICAL PROPERTIES OF THIN LAYERS OF CADMIUM XIDE IN THE INFRARED SPECTRAL REGION. V.K.Miloslavskii.
ptika i Spektrosk., Vol. 3, No. 3, 251-7 (Sept., 1957). In Russian.

The optical absorption of CdO films in the 1-16 μ spectral region was studied. The films were prepared by sputtering. Their electrical conductivities ranged from 0.01 to 10^3 ohm^{-1} cm^{-1} and depended strongly on the conditions under which the films were prepared. The observed complex structure of optical absorption of CdO is ascribed to excess cadmium atoms in the crystal lattice. With increase of the amount of excess Cd in CdO the latter's electrical conductivity and optical absorption increased. The results obtained agree satisfactorily with deductions from free-electron theory. A.Tybulewicz

535.345 : 536.3

EXPERIMENTAL VERIFICATION OF THEORETICAL RELATIONS BETWEEN TOTAL GAS ABSORPTIVITIES AND TOTAL GAS MISSIVITIES FOR CO. See Abstr. 8030

535.345.6

448. ZEEMAN-SPLIT ABSORPTION LINES AS VERY NARROW PASS FILTERS. K.G.Kessler and W.G.Schweitzer, Jr.
. Opt. Soc. Amer., Vol. 49, No. 2, 199 (Feb., 1959).

If the σ components undergo sufficient Doppler broadening, there will be a very narrow band pass between them. With Hg^{198} vapour at 100°C in a field of 968 oersted, the portion of the resonance line transmitted has a width of 0.01 cm^{-1}; the coherent length of this should be more than 135 cm. G.F.Lothian

535.345.6

449. EFFECT OF ULTRAVIOLET RADIATION ON HOSHINO—YOSHIDA FILTERS. M.A.Jeppesen.
. Opt. Soc. Amer., Vol. 49, No. 5, 489 (May, 1959).

These filters, for isolation of Hg 2537 A line, are considerably leached by ultraviolet radiation. G.F.Lothian

535.345.6

9450. AGEING OF NEUTRAL GLASS FILTERS. W.R.Blevin.
Optica Acta, Vol. 6, No. 1, 99-101 (Jan., 1959).

The increase in transmissivity with age as measured on seven Chance glass neutral density filters is shown to be due to natural blooming of the glass surface on prolonged exposure to the atmosphere. R.A.Weale

535.361.2

9451. THE CALORIMETRIC DETERMINATION OF THE DIFFUSE REFLECTANCE OF MAGNESIUM OXIDE. G.Gergely.
Optica Acta, Vol. 3, No. 4, 197-9 (Dec., 1956).

The reflection factor of a layer of MgO powder 1 mm thick was measured for five lines in the spectrum of a high pressure mercury vapour lamp. The values obtained ranged from 83% at 253.7 mμ to 99% at 546.0 mμ. The results in the u.v. are considerably lower than those found by previous workers. J.W.T.Walsh

535.361.2

9452. DETERMINATION OF THE SPECTRAL COEFFICIENTS OF DIFFUSE REFLECTION OF INFRARED RADIATION FROM BLACKENED SURFACES. B.P.Kozÿrev and O.E.Vershinin.
Optika i Spektrosk., Vol. 6, No. 4, 542-9 (April, 1959). In Russian.

In measurement of the spectral dependence of reflection in the infrared region, when the radiation sources emit small amounts of energy and thermal receivers have low sensitivity, it is necessary to collect, if possible, all the diffusely reflected radiation at the receiver. This can be done by means of a hemi-spherical mirror which collects radiation proceeding from a blackened sample A and focuses it at a receiver A'. The two points A and A' are conjugate with respect to the hemisphere centre O. The authors describe apparatus with such a mirror as main component, and which can be used to determine absolute values of specular and diffuse reflection coefficients in the infrared region. The apparatus was used to measure the coefficients of reflection from metallic surfaces covered by various types of soot, or with Bi, Zn, Te and Sb blacks. A.Tybulewicz

535.37 : 530.145

ABSORPTION AND LUMINESCENCE OF A HARMONIC OSCILLATOR. See Abstr. 9201

535.37

9453. A REVIEW OF NON-SULPHIDE PHOSPHORS. S.T.Henderson.
Semiconductors and phosphors. See Abstr. 9597. pp. 263-8.

A short qualitative review of the main inorganic phosphors, other than zinc and cadmium sulphide. It includes 60 references. J.B.Birks

535.37

9454. NON-ELECTRONIC ENERGY MIGRATION IN PHOSPHORS. W.Hoogenstraaten.
Semiconductors and phosphors. See Abstr. 9597. pp. 285-305. In German.

Of the mechanisms proposed to explain sensitized fluorescence in inorganic phosphors only two, energy transfer by metastable excitons of the base lattice, and resonance transfer between sensitizers and activators, do not contradict the qualitative behaviour of these phosphors. The quantum mechanical theory of resonance transfer by dipole—dipole, dipole—quadrupole and exchange interaction is discussed in some detail. The theories associated with the transfer mechanisms are compared with the experimental results on the relative efficiencies of sensitizer and activator fluorescence as a function of relative concentrations. From this comparison it appears that resonance transfer from sensitizer to activator, either directly or via other activators, is the most probable mechanism of sensitized fluorescence. A short account of host-sensitization is given. J.B.Birks

535.37

9455. TWO KINDS OF LUMINESCENT CENTRE DUE TO MANGANESE IN THE SYSTEM CADMIUM—LITHIUM ORTHOSILICATE. V.V.Osiko.
Dokl. Akad. Nauk SSSR, Vol. 121, No. 3, 507-10 (1958). In Russian.

The luminescence spectra of various compositions in the system $2CdO.SiO_2.0.005\ Mn—2\ Li_2O.SiO_2.0.005\ Mn$ were studied (excitation by 2540 A radiation or 6 kV electrons). These and X-ray data were interpreted on the basis of the existence of a single intermediate phase. The red or green luminescence obtainable was ascribed to differences in coordination of the Mn activator, and not to the existence of two distinct phases (see also Abstr. 3602 of 1955). C.H.L.Goodman

535.37

9456. FLUOROMETRIC MEASUREMENTS WITH LOW FREQUENCY LIGHT CURRENT MODULATION.

A.M.Bonch-Bruevich and V.P.Kovalev.
Pribory i Tekh. Eksper., 1959, No. 2, 49-52 (March-April).
In Russian.

Discusses in general terms with a block diagram a two-channel phasometric fluorometer with modulation in the range 10-20 kc/s for measuring luminescence lifetimes of 10^{-3}-10^{-7} sec. Resolution is of the same order as with the familiar high-frequency types (modulation 5-15 Mc/s). A further block diagram illustrates a modulation method of finding the phase shift in rapidly damped luminescent processes, with the advantage of greater excitation light current than is possible with present h.f. fluorometers; the scattered and luminescent light are here observed alternately, a compensating phase-shift being introduced synchronously into one of the phasemeter channels. D.E.Brown

535.37

9457. AN EXPERIMENTAL PHASE FLUOROMETER.

A.M.Bonch-Bruevich, I.V.Karazin, V.A.Molchanov and V.I.Shirokov.
Pribory i Tekh. Eksper., 1959, No. 2, 53-6 (March-April).
In Russian.

Describes and illustrates schematically the high sensitivity optical section based on a SVDSh-250 super-pressure valve, and the symmetrical two-channel phasometric section. A photograph shows the finished equipment complete in one box. The phase resolution is ~ 0.1°, corresponding to 2×10^{-11} sec for the chosen modulation frequency. Accuracy of single definition of time constant t of exponential decay is better than 2% with bright luminosity, and e.g. 5% for t = 10^{-9} to 10^{-8} sec, 20% for t = 2.5×10^{-10} to 10^{-7} sec. D.E.Brown

535.37

9458. A MULTI-FREQUENCY PHASE FLUOROMETER WITH DOUBLE FREQUENCY CONVERSION.

S.F.Kilin, G.P.Prosin and I.M.Rozman.
Pribory i Tekh. Eksper., 1959, No. 2, 57-8 (March-April).
In Russian.

Describes with the aid of a block diagram, and comments on the advantages of, additions to the phasometric device earlier described in Pribory i Tekh. Eksper., 1956, No. 2, 54, whereby operating frequencies of 8, 12, 15 and 20 Mc/s are made available. D.E.Brown

535.37

9459. RED-LUMINESCING QUARTZ. E.W.Claffy and R.J.Ginther.

J.Opt. Soc. Amer., Vol. 49, No. 4, 412-13 (April, 1959).

The phosphor was synthesized from amorphous pure silicic acid fired in H_2 at 1200°C with activators in the molar proportions 90 SiO_2 : 10 MnO : 0.1 Al_2O_3, and in crystal structure was essentially quartz. It was excited by u.v. only after exposure to X-rays. The cathodoluminescence was a broad band with peak at 6500 A, and initially exponential decay. S.T.Henderson

535.37

9460. EFFECT OF A MAGNETIC FIELD ON THE LINES OF BLUE FLUORESCENCE OR LUMINOUS ABSORPTION OF CERTAIN PURE CRYSTALS OF CADMIUM SULPHIDE COOLED TO 4.2°K.

E.F.Gross, E.Grillot, B.P.Zakhartchenia and M.Bancie-Grillot.
C.R. Acad. Sci. (Paris), Vol. 248, No. 2, 213-16 (Jan. 12, 1959).
In French.

Emission spectra were obtained from CdS crystals cooled to 4.2°K under ultraviolet excitation. With a magnetic field perpendicular to the hexagonal axis of the crystals, three lines showed Zeeman doubling, no such effect occurred with the field parallel to the axis. J.Franks

535.37

9461. STUDIES OF THE FLUORESCENT EMISSION LINES AND LUMINESCENT ABSORPTION LINES IN CRYSTALS OF PURE CADMIUM SULPHIDE COOLED TO 4.2°K.

M.Bancie-Grillot, E.F.Gross, E.Grillot and B.S.Razbirine.
C.R. Acad. Sci. (Paris), Vol. 248, No. 1, 86-9 (Jan. 5, 1959).
In French.

Earlier data are improved using a spectrograph of much higher dispersion. A new fluorescent line is reported at λ = 4868.2 A. B.T.M.Willis

535.37 : 539.1

9462. MOLECULAR PHOSPHORESCENCE AT LIQUID NITROGE TEMPERATURE. VIBRATIONAL STRUCTURE OF SOME AROMATIC AND HETEROCYCLIC DERIVATIVES.

A.Rousset, R.Lochet and J.L.Dubarry.
C.R. Acad. Sci. (Paris), Vol. 248, No. 1, 54-8 (Jan. 5, 1959).
In French.

The emission spectra at liquid N temperature were obtained for aromatic and heterocyclic derivatives. The fundamental and harmonics of various bands are given. J.Frank

535.37 : 539.2 : 537.53

EFFECT OF EXCESS CHLORINE ON THE LUMINESCENCE O NaCl. See Abstr. 8205

535.37 : 539.

TRANSIENT PROCESSES IN THE OPTICAL BLEACHING OF F AND F' CENTRES IN POTASSIUM CHLORIDE. See Abstr. 8856

535.37

9463. QUENCHING OF PHOTOLUMINESCENCE OF SOLUTIONS BY ENERGY TRANSFER. A.Jabłoński.

Bull. Acad. Polon. Sci. Ser. Sci. math. astron. phys., Vol. 6, No. 1
663-9 (1958).

The author's previous theory (see Abstr. 9095 of 1957) of the
photoluminescence yield of solutions containing quencher molecule
is modified, using an improved model of the luminescent centre wi
an active sphere. The dependence of quenching probability on the
distance of the quencher from the luminescent molecule, and quenc
ing by quenchers outside the active sphere, are taken into account.
By suitable choice of the radius of the active sphere, excellent agreement is obtained between the theoretical and experimental yield versus quencher concentration curves. J.B.Birk

535.37

9464. ON THE DEPENDENCE OF EMISSION ANISOTROPY OF FLUORESCENCE ON THE CONCENTRATION OF LUMINESCENT MOLECULES IN PLEXIGLASS LUMINOPHORS. A.Kawski.

Bull. Acad. Polon. Sci. Ser. Sci. math. astron. phys., Vol. 6, No. 10, 671-5 (1958).

The emission anisotropy (degree of polarization) of the fluorescence of rigid solutions of "yellowish eosin" and of "rhodamin B
in polymethyl methacrylate decreases with increasing concentratio
Within the range of low concentrations studied, the results agree with Jabłoński's theory of self-depolarization. J.B.Bir

535.3

9465. THE CONCENTRATION DEPENDENCE OF THE QUANTU YIELD OF LUMINESCENCE OF SOLID ORGANIC PHOSPHORS WITH ADMIXTURES. V.M.Agranovich.

Optika i Spektrosk., Vol. 3, No. 1, 29-37 (July, 1957). In Russian.

There are two theories of the luminescence mechanism in mixed organic phosphors, such as anthracene in naphthalene or anthracene in polystyrene. Birks (1955) suggested a radiative
mechanism with luminescence of the admixture due to absorption
luminescence of the basic substance. A radiationless mechanism
was suggested by others, with transfer of energy achieved by reso
ance interation between excited molecules of the basic substance
and molecules of the admixture. This paper is an attempt to eluci
date theoretically the role of both these mechanisms at various admixture concentrations. The total quantum yield is obtained as
the sum of two quantum yields due to the two mechanisms of lumin
escence. It was found that as concentration of admixture is increased the quantum yield due to the radiative mechanism begins
fall while the quantum yield due to the radiationless mechanism continues to increase until saturation is reached. This supports a
conclusion reached by others that Birks' mechanism holds only fo
low admixture concentrations. At very high admixture concentrat
a concentration quenching effect occurs and the total quantum yiel
begins to decrease. A.Tybulewi

535.3

9466. ON THE EFFECT OF RE-ABSORPTION ON THE DURATION OF FLUORESCENCE OF MOLECULAR CRYSTALS.

V.M.Agranovich.
Optika i Spektrosk., Vol. 3, No. 1, 84-7 (July, 1957). In Russian.

For many molecular crystals it is possible to regard fluores
ence transitions as occuring from exciton bands which correspon
to the lowest level of excitation in an isolated molecule. To deter
mine fluorescence yield it is therefore sufficient to know exciton density in the energy bands which correspond to the lowest levels

f excitation. The number of such bands is equal to the number of nolecules in a unit cell. The width of such bands is about 0.05 eV nd they can, in general, overlap. If they do not overlap, the width f the forbidden intervals between the bands is about 0.01 eV. At oom temperature thermal motion causes blurring and diffusion of uch bands. As a result, an electron-vibration—rotation band is ormed in place of the exciton bands. By a purely mathematical rgument the author finds the quantum yield Q for this particular ase. To determine Q experimentally it is necessary to measure uration (lifetime) of fluorescence at very large and at very small alues of the coefficient of absorption of the exciting light, and to btain the relative distribution of fluorescence in thin crystals, here re-absorption of light can be neglected. A.Tybulewicz

535.371

467. ELECTRON-ACCEPTOR LEVELS IN ALKALI-HALIDE RYSTAL PHOSPHORS, WHICH ARE DUE TO THE ACTIVATOR. .M.Shamovskii and Yu.N.Zhvanko.

ptika i Spektrosk., Vol. 3, No. 3, 267-71 (Sept., 1957). In Russian.

Interaction of the activator with electrons and holes introduced nto the crystal by additive colouring was studied in alkali-halide hosphors KI:Tl, KI:In, NaCl:Hg and KCl:Ag. It was found that the ctivator was raised to the atomic state by capturing electrons at ontact surfaces of polyhedral substructure. The activator band isappears then completely and the crystal loses its ability to uminescence. Additional bands characteristic of the activator toms and their colloidal aggregates appear in the absorption specrum. Holes do not interact with the activator and ionized centres f emission are not formed. The results are best represented by a and model proposed by Lambe and Klick for ZnS phosphors. The atter two authors regard luminescence as a recombination of a hole vith an electron localized at the activator. The present authors add limitation that electrons can be localized only at contact surfaces. A.Tybulewicz

535.371 : 539.2

468. ON POLARIZED LUMINESCENCE OF COLOURED RYSTALS. V.L.Vinetskii and M.F.Deigen.

ptika i Spektrosk., Vol. 4, No. 1, 60-5 (Jan., 1958). In Russian. nglish summary: PB141047T-3, obtainable from Office of echnical Services, U.S. Dept. of Commerce, Washington, D.C., .S.A.

A theoretical paper which discusses optical transitions to arious excited states of F_2 and F_2^+ centres. Feofilov's classical reatment is considered in detail, and a quantum-mechanical interretation of his results is given. It is shown that the experimental ata on the azimuthal dependence of the degree of polarization of uminescence agree with results calculated for F_2 and F_2^+-centres. uantitative calculations are made for a KCl crystal. J.B.Birks

535.371

469. A RELATIONSHIP BETWEEN THE BLUE AND RED MISSION BANDS IN THE ZnS:Co PHOSPHOR. N.A.Tolstoi.

ptika i Spektrosk., Vol. 3, No. 1, 73-5 (July, 1957). In Russian.

Preliminary results are reported on the relationship between he steady-state emissions of the blue (Zn) and red (Co) bands of the nS:Co phosphor containing 5 p.p.m. by weight of Co. As temperature s increased from −20° to +120°C the blue emission intensity falls nd the red emission becomes stronger. This is due to transfer of lectrons or holes from short-wavelength centres (first localization evels) to other, energetically lower, localized states (second localzation) which are located at the long-wavelength centres of emission; he rate of this transfer increases with temperature. A.Tybulewicz

535.371

470. INVESTIGATION OF THE INITIAL STAGES OF LUMINSCENCE RISE IN THE ZnS:Cu,Co PHOSPHOR. G.M.Eliashberg.

ptika i Spektrosk., Vol. 4, No. 1, 66-75 (Jan., 1958). In Russian. nglish summary: PB141047T-3, obtainable from Office of echnical Services, U.S. Dept. of Commerce, Washington, D.C., .S.A.

A thin layer (4 mg/cm²) of the phosphor, excited with 313, 365, 05 and 436 mμ radiation, was studied over a wide range of excitaion intensities and at various temperatures. Increase in the intenity of excitation E decreases the length of the linear portion of the ise curve in inverse proportion to E. The gradient of the linear ortion increases as $E^{1.6}$. Similar results are obtained at the 4 xcitation wavelengths. Increase of temperature from 20° to 100°C ncreases the rate of rise of luminescence, but the form of the rise urve in the initial stages is practically unchanged. It is concluded hat the initial stages of the luminescence rise are related to the presence of a small number (about 10^{14} cm^{-3}) of very deep capture levels (T-traps) and that in the excitation process almost all T-traps are filled, mainly by optical electrons. J.B.Birks

535.371

9471. THE EFFECT OF DIMENSIONS OF CRYSTALLINE GRAINS ON THE CHARACTERISTICS OF FLASH RISE [OF LUMINESCENCE] IN ZnS:Mn PHOSPHORS. Z.S.Mansurova.

Optika i Spektrosk., Vol. 4, No. 4, 529-32 (April, 1958). In Russian. English summary: PB141047T-9, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The duration of the dark interval before the flash is practically independent of grain size, whereas there is an optimum grain size at which the relative magnitude of the flash (ratio of maximum to steady-state brightness) is a maximum. Radiationless transitions are important in smaller grains, and this causes a fall of the steady-state emission and loss of ability to produce a flash.

B.T.M.Willis

535.371

9472. DETERMINATION OF THE ABSOLUTE VALUES OF THE PARAMETER γ, EQUAL TO THE RATIO OF PROBABILITIES OF LOCALIZATION AND RECOMBINATION, FOR THE ZnS—Cu PHOSPHOR. F.I.Vergunas and Yu.L.Lukontsever.

Optika i Spektrosk., Vol. 5, No. 2, 156-61 (1958). In Russian. English summary : PB141047T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The ratio of the probabilities of trapping and recombination γ is derived for phosphors with one depth of trapping levels and one type of emission centres. Experimental confirmation was obtained with a ZnS:Cu phosphor, that as the temperature increased, γ first increased and then tended to zero as thermal quenching occurred.

J.Franks

535.371

9473. ON THE INTERACTION OF "BLUE" AND "SAMARIUM" CENTRES IN THE ZnS:Sm(Cl) PHOSPHOR. Z.A.Trapeznikova.

Optika i Spektrosk., Vol. 6, No. 4, 512-16 (April, 1959). In Russian.

Reports studies of the dependence of the intensity of luminescence due to "blue" and activator centres on the intensity of excitation in ZnS:Sm and ZnS:Sm(Cl) and of the temperature dependence of the luminescence spectra of these phosphors. An interpretation of the results obtained is given and a mechanism of energy transfer between "blue" and "samarium" centres is suggested.

A.Tybulewicz

535.371 : 539.2

9474. ELECTRON TRAPS IN ZINC SULFHIDE PHOSPHORS. W.Hoogenstraaten.

Philips Res. Rep., Vol. 13, No. 6, 515-693 (Dec., 1958).

An experimental study of electron traps in ZnS; Zn,CdS and ZnS,Se phosphors was made, largely by glow curve and related techniques. The relation of traps to phosphor constitution, particularly to impurity activators and co-activators, was examined, including special effects of transition element impurities such as Ni and Co. The characteristic glow curve peaks of ZnS are explained in terms of lattice anion vacancies or of substitutional oxygen atoms in appropriate cases. Evidence is presented of slow luminescence decay in ZnS—Cu—Co phosphors at 77°K, which is not due to thermal activation of trapped electrons but to a tunelling process. The theoretical section deals with the wave-functions and energy states for various luminescence and trapping centres in ZnS. Activator—co-activator pair theory is discussed and the paired centres are concluded to be unlikely in ZnS.

G.F.J.Garlick

535.371

9475. ON A RELATIONSHIP BETWEEN THE INTRINSIC AND TECHNICAL YIELDS OF LUMINESCENCE OF INFINITELY THICK LIGHT-SCATTERING LAYERS. A.P.Ivanov and S.M.Mosunova.

Optika i Spektrosk., Vol. 4, No. 2, 245-51 (Feb., 1958). In Russian. English summary: PB141047T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

In scattering media where luminescence undergoes multiple reflections the technical luminescence yield ηt is less than the intrinsic yield ηi. A formula is derived for ηt in terms of ηi and the optical constants of the layer, and numerical values are tabulated for various absorption and scattering coefficients. The formula was verified by measurements on dispersions of uranium glass powders, at excitation wavelengths of 265, 334 and 365 mμ. The effects of excitation wavelength, refractive index of the binder (air, water or alcohol), and powder size are considered, and it is shown that η_i is constant and practically equal to that of a thin uranium glass plate. J.B.Birks

535.371

9476. DURATION OF PHOTOLUMINESCENCE OF ALKALI HALIDE CRYSTALS, ACTIVATED WITH Tl or In. I.K.Plyavin'.
Optika i Spektrosk., Vol. 4, No. 2, 266-8 (Feb., 1958). In Russian. English summary : PB141047T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

An electric spark of about 10^{-8} sec duration was used for excitation, filters being used so that only the activator centres and not the crystal lattice were excited. The decay was observed by oscillograms of single luminescence pulses detected by a photomultiplier. The crystal temperature was varied from −170° to +100°C. The luminescence decay of all the crystals studied was exponential. At room temperature the decay times (μsec) observed were: NaI:Tl 0.22, KI:Tl 0.28, KCl:Tl 1.5, CsI:Tl 0.80, NaI:In 2.4, KI:In 3.1, RbI:In 3.4, CsI:In 2.4, NaBr:In 2.4, KBr:In 3.8, RbBr:In 4.7, CsBr:In 7.1, NaCl:In 3.4, KCl:In 3.1, RbCl:In 4.7. The luminescence decay time of crystals activated with Tl depends strongly on temperature: if the decay time is plotted as a function of the reciprocal of the absolute temperature the dependence is exponential. This shows that the observed time constants are not really the decay times of the emission transitions, but that they correspond to thermal liberation of electrons or holes from shallow metastable levels or capture levels. J.B.Birks

535.371

9477. THEORY OF QUENCHING OF FLUORESCENCE IN SOLUTIONS. I.M.Rozman.
Optika i Spektrosk., Vol. 4, No. 4, 536-8 (April, 1958). In Russian. English summary: PB141047T-9, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The author refers to the criticism by Sveshnikov (Abstr. 5216 of 1957) of theories by Förster (Abstr. 3262 of 1948) and by Galanin (Abstr. 5007 of 1956), and shows that a derivation of a similar decay law and quantum yield of fluorescence is possible on yet other assumptions as to the physical processes involved. G.F.J.Garlick

535.371

9478. DEPENDENCE OF AFTERGLOW DECAY LAW OF FLUORESCEIN ACTIVATED BORIC ACID PHOSPHORS. V.A.Pilipovich and B.Ya.Sveshnikov.
Optika i Spektrosk., Vol. 4, No. 4, 541-3 (April, 1958). In Russian. English summary: PB 141047T-9, obtainable from Office of Technical Services, U.S. Dept, of Commerce, Washington, D.C., U.S.A.

Experiments show that the decay of the fluorescein luminescence is slower in specimens cooled slowly from the melt. Reproducibility of results demands that care should be taken to avoid overheating of the melt. G.F.J.Garlick

535.371

9479. POLARISATION OF LUMINESCENCE AND THE NATURE OF LUMINESCENT CENTRES IN NaCl:Ag AND KCl:Tl CRYSTALS L.I.Tarasova and P.P.Feofilov.
Optika i Spektrosk., Vol. 4, No. 5, 696-7 (1958). In Russian. English summary: PB141047T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The azimuthal dependence of the polarization of luminescence was measured to determine the orientation of the anisotropic luminescence centres. The centres responsible for visible luminescence are anisotropic and oriented along the cubic axes. B.T.M.Willis

535.371 : 537.312.5

9480. ON THE RELATIONSHIP BETWEEN THE DECAY LAWS FOR PHOSPHORESCENCE AND PHOTOCONDUCTIVITY. K.K.Rebane.
Optika i Spektrosk., Vol. 5, No. 1, 95-6 (1958). In Russian. English summary: PB 141047T-6, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The quantitative form of decay for emission and photoconduction is considered for two different energy band models. In the first electron conduction is assumed to occur, recombination occurring with specific activator levels lying above the valence band. In the second case, the kinetics for a more general distribution of trapping states and activator recombination centres are considered. G.F.J.Garlick

535.371

9481. TRANSFORMATION OF LIGHT BY ATOMS AND MOLECULES. P.A.Apanasevich.
Optika i Spektrosk., Vol. 5, No. 2, 97-109 (1958). In Russian. English summary: PB141047T-5, obtainable from Office of Technic Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

A theoretical treatment of the emission of radiation from an illuminated solid, dealing with fluorescence and phosphorescence. Atoms in the ground state, and excited atoms and molecules are considered. C.Hilsum

535.371 : 539.2

FLUORESCENCE IN THE SYSTEM $Zn(PO_3)_2-Mg(PO_3)_2$. See Abstr. 8855

535.372 : 771.531

9482. SPECTRAL COMPOSITION AND INTENSITY OF LUMINESCENT RADIATION OF A PHOTOGRAPHIC EMULSION. O.Nováková.
Czech. J. Phys., Vol. 7, No. 4, 476-80 (1957). In Russian.

A study is made of the spectral composition of luminescent radiation of various photographic materials and of the effect of pre-exposure and pressure on the spectral composition and intensity of luminescent radiation. The spectral composition of luminescent radiation was determined spectrographically. The decrease in intensity of the luminescent radiation was determined relatively on th basis of the characteristic curve of the plate used for recording. The spectral composition of luminescent radiation was determined for five negative and three positive photographic materials. In the luminescent spectrum of negative photographic materials two maxima were found — in the green part of the spectrum in the region λ = 536-559 mμ according to the type of emulsion used, and in the r part of the spectrum λ = 625-645 mμ. With positive silver chloride emulsions only one maximum λ ≅ 485 mμ was found. Pre-exposure to which there corresponds a density greater than 2.5 and direct visible blackening, causes a decrease in intensity of the fluorescent radiation of the photographic film. This decrease takes place throughout the spectrum. The magnitude of the decrease in intensit is dependent on the temperature during the pre-exposure of the spec mens. The decrease in intensity grows with the period of illumination for otherwise constant conditions of illumination. Static pressure (500-3000 kg/cm²) and impact pressure (falling weight of 4.5 kg from a height of 20-100 cm) also causes a decrease in intensity of the luminescence without change in the spectral composition. Both phenomena were qualitatively verified on all five negative photographic materials and depend quantitatively on the kind of emulsion. It was found by measurement that pressure and illumination do not mutually cancel each other. The decrease obtained by pressure-exposure and exposure-pressure is greater than the decrease cause by pressure or pre-exposure individually. An explanation is attemp for the influence of pre-exposure on the intensity of luminescent radiation.

535.37

9483. ON EMISSION OF EXCITED PHOSPHORS ZnS:Mn. V.L.Lëvshin, N.S.Borodin and G.P.Neronova.
Optika i Spektrosk., Vol. 3, No. 3, 258-66 (Sept., 1957). In Russian.

The emission intensity of Mn in ZnS:Mn phosphors (0.001 g/g Mn, prepared at 850°C) was studied at fixed temperatures from 20° to 170°C and at various intensities of the exciting light; emission intensities and spectra were measured also at fixed exciting intensities but at different temperatures. The observed dependences ar due to transitions of holes or electrons to or from Mn or Zn levels They can be explained using a model which takes into account electron motion in the conduction band and hole motion in the valen band. The authors also studied emission spectra of ZnS:Mn phosphors which contained different amounts of Mn and were prepa at different temperatures (sphalerite modification prepared at 850° and wurtzite modification prepared at 1200°C). It was found that: (1) on increase of temperature from 18° to 100°C Zn emission disa pears but is fully compensated by increase of Mn emission; (2) preparation of the phosphor at a higher temperature tends to strengthe the Mn emission; (3) increase of Mn concentration from 0.001 to 9.01 g/g causes a strong increase of Mn emission and total disappearance of Zn emission. A.Tybulewic

535.372 : 539.

9484. INVESTIGATION OF THE ABSORPTION AND LUMINESCENCE SPECTRA OF ALKALI-HALIDE CRYSTALS ACTIVATED WITH NICKEL. M.L.Kats and B.Z.Semenov.
Optika i Spektrosk., Vol. 4, No. 5, 637-42 (1958). In Russian. English summary : PB141047T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C.

Absorption, emission and excitation spectra were studied together with the changes in these spectra following X-ray irradiation.
B.T.M.Willis

535.372

9485. ON THE RELATIONSHIP BETWEEN THE LUMINESCENCE AND ABSORPTION SPECTRA OF COMPLEX MOLECULES.

M.N.Alentsev.

Optika i Spektrosk., Vol. 4, No. 5, 690-2 (1958). In Russian. English summary : PB141047T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Stepanov's equation for the ratio of the luminescence power and absorption coefficient in terms of the temperature and frequency assumes an equilibrium distribution of the vibrational levels corresponding to the temperature T of the medium; however, application of this equation to experimental data indicates that the vibrational-level equilibrium is normally achieved at a temperature $T' > T$. The author suggests a more general equation allowing T' to exceed T, and this equation gives fair agreement with experiment.
B.T.M.Willis

535.372

9486. LUMINESCENCE OF TRIVALENT YTTERBIUM.

P.P.Feofilov.

Optika i Spektrosk., Vol. 5, No. 2, 216-19 (1958). In Russian. English summary: PB 141047T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Absorption and luminescence emission measurements were made with CaF_2:Yb single crystals grown from the melt. Absorption bands were obtained with peaks at 2550 A and 3650 A and an intense doublet at 9740 A. Under ultraviolet excitation, sharp luminescence lines were obtained in the infrared, including a coincidence with the absorption doublet. The electron transitions are deduced. Observations were also made of the resonance luminescence of Yb ions in SrF_2, BaF_2, La_2O_3 and ThO_2 crystals, and in borax beads. J.Franks

535.372 : 535.343

LUMINESCENCE OF STILBENE IMPURITY IN DIBENZYL AND TOLANE CRYSTALS AT 20.4°K. See Abstr. 9419-20

535.372 : 535.231.2

ON "CANDOLUMINESCENCE" OF CaO AND Al_2O_3.

See Abstr. 9366

535.373

9487. PHOSPHORESCENCE OF ACETIC ACID. K.Osada.

J. Phys. Soc. Japan, Vol. 12, No. 12, 1420 (Dec., 1957).

Acetic acid does not show emission at −60°C when pure but small admixtures of sodium acetate, potassium chloride or sodium bicarbonate, produce a weak green emission. It is suggested that the emission is due to sodium or potassium ions in association with the acetic ions in the solidified acetic acid. G.F.J.Garlick

535.376 : 621.383.2.032.35

9488. BIBLIOGRAPHY ON ELECTROLUMINESCENCE AND RELATED TOPICS. H.F.Ivey.

I.R.E. Trans Electron Devices, Vol. ED-6, No. 2, 203-15 (April, 1959).

Seven hundred and twenty items are grouped into the following sections: General references on electroluminescence; General references on effects of electric fields in solids; Electroluminescence in zinc sulphide; Electroluminescence in other materials; Field effects in excited phosphors; Galvanoluminescence; Applications of electroluminescence; Patents.

535.376

9489. ON THE POLARIZATION OF ATOMIC LUMINESCENCE DURING EXCITATION WITH SLOW ELECTRONS. G.G.Dolgov.

Optika i Spektrosk., Vol. 4, No. 2, 268-71 (Feb., 1958). In Russian. English summary : PB141047T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The polarization of emission of the He line at 5516 A as a function of the energy of the exciting slow electrons has been measured photoelectrically at a He pressure of 0.0005 mm Hg. The results are compared with a theoretical curve, calculated for excitation of the 2p-level of hydrogen, using the first Born approximation, which is qualitatively applicable to He. The main difference between theory and experiment occurs at low energies. The inclusion of exchange in the Born approximation, and the use of distorted waves does not improve the agreement. It is shown that calculations based on the assumption of strong coupling yield zero polarization at low electron energies, as observed, and a reasonable position of the polarization maximum. J.B.Birks

535.376 : 539.1.07

9490. A SIMPLE METHOD FOR THE ESTIMATION OF THE EFFICIENCY OF A NaI WELL-TYPE SCINTILLATOR.

W.D.Schmidt-Ott.

Z. Phys., Vol. 154, No. 3, 294-300 (1959). In German.

As an extension of previous calculations of the efficiency of well-type scintillators by the summation of two successive cascade quanta, a method is suggested whereby the efficiency is estimated by an analysis of sum-spectra resulting from the simultaneous emission of two quanta within the well of the scintillator. S.J.St-Lorant

535.376

9491. ON THE PHOTOELECTROLUMINESCENCE OF ZnS:Cu.

K.Pátek.

Czech. J. Phys., Vol. 8, No. 5, 612-3 (1958). In Russian.

The effect of u.v. illumination on the electroluminescence of ZnS:Cu is studied. Brightness waveforms are shown, for trapezoidal applied voltages, both for the intrinsic electroluminescence and for photoelectroluminescence. From these, the effect of the illumination intensity on the primary and secondary brightness peaks is obtained for various frequencies. The observed effects, which occur analogously for both ZnS:Cu radiation bands, are accounted for by the increase of conduction electrons with u.v. illumination; this reduces the effect of polarization in the ZnS crystals and also increases the number of field accelerated electrons.
V.V.Zakharov

535.376

9492. ELECTROLUMINESCENT THIN FILMS. W A.Thornton.

J. appl. Phys., Vol. 30, No. 1, 123-4 (Jan., 1959).

Electroluminescent phosphors ZnS : Cu, Cl and ZnS : Cu, Mn, Cl may be evaporated on to conducting glass to form transparent films 1-5 μ thick. These are electroluminescent to a.c. fields, and also to d.c. S.T.Henderson

535.376 : 621.383.2.032.3

9493. PARTICLE SIZE AND EFFICIENCY OF ELECTROLUMINESCENT ZINC SULFIDE PHOSPHORS. W.Lehmann.

J. Electrochem. Soc., Vol. 105, No. 10, 585-8 (Oct., 1958).

The brightness and the electric power absorption of an electroluminescent ZnS phosphor depend on the mean particle size of the phosphor. For constant amounts of phosphor by weight excited under identical conditions, decreasing particle size causes strongly decreased brightness at low voltages. However, at high voltages the brightness remains unchanged or tends to increase. At all voltages, the electric power absorption is proportional to the particle size. The efficiency, i.e. the ratio of brightness to power absorption, increases with decreasing particle size. With fine particles of a green emitting phosphor, a luminous efficiency of 14 lm/W of a complete cell (corresponding to 18-19 lm/W of the phosphor itself) could be measured.

535.376

9494. EFFECT OF TEMPERATURE ON ELECTROLUMINESCENCE OF POWDER PHOSPHORS.

O.N.Kazankin and L.N.Petoshina.

Optika i Spektrosk., Vol. 4, No. 1, 76-81 (Jan., 1958). In Russian. English summary : PB141047T-3, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Measurements were made from −160° to +100°C on the following phosphors: (ZnS, ZnSe):Cu; ZnS:Cu,Mn; ZnS:Cu,Pb; ZnS:Cu,Al; ZnS:Cu. Electroluminescence was excited by an alternating field of frequency 50-20 000 c/s. From −160° to −50°C the intensity was nearly constant; on further heating it rapidly reached a maximum, which was different for different phosphors. Quenching substances (Co and ZnO) displaced the maximum to lower temperatures, and increase of applied field frequency moved it to higher temperatures. A theory of Thornton (Abstr. 3643 of 1956) gives intensity—temperature curves similar to those observed. B.T.M.Willis

535.376

9495. INVESTIGATION OF RELAXATIONAL PROCESSES IN ELECTROLUMINESCENCE. A.N.Georgobiani and M.V.Fok.

Optika i Spektrosk., Vol. 5, No. 2, 167-71 (1958). In Russian. English summary : PB141047T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Measurements of electroluminescence brightness waves were

made on ZnS : Cu, Al phosphors. The mean brightness depended on the amplitude, frequency and waveform of the applied voltage. The ratio of the constant to the alternating component of electroluminescence depended on frequency and waveform but was practically independent of amplitude. The quenching effects of red light are discussed. The alternating component of electroluminescence built up more rapidly than the constant component; the alternating component is due to the liberation and recombination of electrons in the high field region of the phsophor grains, the constant component to hole and electron processes in the field-free region.
J.Franks

535.377

9496. THERMOLUMINESCENT MONOCRYSTALS OF CaSO$_4$—Mn. V.A.Arkhangel'skaya, B.I.Vainberg and T.K.Razumova.
Optika i Spektrosk., Vol. 4, No. 5, 681-3 (1958). In Russian. English summary : PB141047T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Large single crystals (1 × 10 × 10 mm^3) containing 0.01-0.1% Mn were prepared from the melt. The thermoluminescent intensity of powders prepared from these crystals was 2-3 times higher than that of powders prepared from solution-grown crystals The thermoluminescence curves of monocrystals and powders differ considerably in the half-width of the main maximum, and the maximum for monocrystals is displaced slightly to lower temperatures.
B.T.M.Willis

535.377 : 539.2

9497. THERMOLUMINESCENCE AND F-CENTERS. I. THEORY. G.Bonfiglioli, P.Brovetto and C.Cortese.
Phys. Rev., Vol. 114, No. 4, 951-5 (May 15, 1959).

After a critical review of the present state of knowledge about thermoluminescence, which is shown to be rather unsatisfactory, the present paper considers in detail thermoluminescence arising from thermal bleaching of F-centres in irradiated alkali halides. A model is proposed, which leads to second-order kinetics for the radiative recombination of F-centres and Luminophor centres (L$_i$) which must be present in the crystal lattice. The formalism concerned is developed, showing how activation energy and probability factors can be determined. A quantitative argument is presented, concerned with the nature of L$_i$-centres and suitable for the identification of their ground levels within the forbidden crystal band.

535.377 : 539.2

9498. THERMOLUMINESCENCE AND F-CENTERS. II. EXPERIMENTAL. G.Bonfiglioli, P.Brovetto and C.Cortese.
Phys. Rev., Vol. 114, No. 4, 956-60 (May 15, 1959).

The theoretical treatment previously developed (see preceding abstract) is used to interpret experiments of thermoluminescence associated with the presence of F-centres in irradiated alkali halides. Some important features of the technique employed are discussed — in particular, the procedure used to establish the proper wavelength belonging to the light emitted in each glow peak. The energy of activation and the probability factors of the phenomenon are determined, and it is shown that the second and third peak of thermoluminescence are probably due to direct radiative recombination of F-centres with V$_2$ and V$_3$-centres. On the contrary it is still uncertain whether the first peak is associated with V$_1$-centres or with Cu ion impurities in the NaCl lattice.

535.377 : 537.533

THERMOLUMINESCENCE AND EXO-ELECTRON EMISSION OF SULPHIDE PHOSPHORS. See Abstr. 8203

535.39 : 525.3

9499. SPECULAR REFLECTION FROM A SPHERICAL SURFACE. E.P.Todd.
J. Opt. Soc. Amer., Vol. 49, No. 5, 491 (May, 1959).

The luminous intensity of a specularly reflecting satellite is calculated when the points of observation is close to it. This is shown to reduce to the earlier result for an infinitely distant point of observation.
R.W.Fish

535.39

9500. THE DEPENDENCE OF OPTICAL CONSTANTS OF GERMANIUM ON TIME. F.Lukeš.
Czech. J. Phys., Vol. 8, No. 4, 491-2 (1958).

The optical constants of a thick evaporated film and of a polished single crystal surface were observed over a period of 100 days, using the polarimetric method; n decreased and k increased, both changes being proportional to the square root of time. These effects would be caused if an oxide film were growing on the surface, and the refractive index and thickness of the film can be calculated from the changes in the germanium optical constants. It appears that in 100 days a film 20 A thick is formed, and it has a refractive index of 2.2.
C.Hilsum

535.39 : 539.215

9501. OPTICAL PROPERTIES OF CARBONATES OF ALKALINE EARTHS. I.S.Gorban'.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 5, 607-12 (1958). In Russian. English summary: PB 141041T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

A study of the influence of structure on the optical properties. The polar diagram of scattered light, and the ratio of the intensity transmitted without deviation to that transmitted with a deviation of 10° were measured and correlated with particle size, layer thickness and layer density.
C.Hilsum

535.39

9502. FIBER OPTICS. V. LIGHT LEAKAGE DUE TO FRUSTRATED TOTAL REFLECTION. N.S.Kapany.
J. Opt. Soc. Amer., Vol. 49, No. 8, 770-8 (Aug., 1959).

For Pt IV see Abstr. 1590 of 1958. In an image transmitting assembly of small diameter fibres, a marked deterioration in image contrast and resolution may occur when there is substantial light leakage between neighbouring fibres at the region of the line contact. Expressions have been derived for the magnitude of flux leakage between neighbouring fibres due to frustrated total reflections and thereby the point-spread function for an uninsulated fibre assembly is computed. Further, the static and dynamic point-spread functions of fibre bundles were measured experimentally and the lower limit in fibre diameter for an image transmitting assembly of uninsulated fibres is derived.

535.39

9503. FIBER OPTICS. VI. IMAGE QUALITY AND OPTICAL INSULATION. N.S.Kapany.
J. Opt. Soc. Amer., Vol. 49, No. 8, 779-87 (Aug., 1959).

The image quality of an uncoated fibre bundle is influenced by light leakage between neighbouring fibres. The point-spread function due to light leakage between neighbouring fibres is used to calculate the static and dynamic frequency response of an uninsulated fibre bundle. The static and dynamic frequency response is also measured for a bundle of uncoated fibres. The possibility of optically insulating smaller diameter fibres by depositing a thin coating of low refractive-index plastic material is well-known. A process for drawing glass fibres with a core of high refractive-index glass and a 1-2 μ thick coating of low refractive-index glass was developed. This method is also used for depositing a second metal coating on fibres and drawing "multiple fibres". A discussion on the dependence of the coating thickness on various parameters of the over-all optical system is given.

535.39

9504. OPTICAL CHARACTERISTICS OF COPPER HALIDES IN THE ABSORPTION BANDS AT THE TEMPERATURE OF LIQUID NITROGEN. L.D.Kislovskii.
Optika i Spektrosk., Vol. 4, No. 1, 98-100 (Jan., 1958). In Russian. English summary: PB 141047T-3, obtainable from Office of Technical Services, U.S. Dept of Commerce, Washington, D.C., U.S.A.

The author used values of the refractive index outside the absorption bands wavelengths corresponding to the maxima and minim on the reflection curve, and the fact of coincidence of the reflection and absorption maxima. Optical characteristics are calculated for CuI, CuCl and CuBr films. The values of half-widths obtained by calculation show poorer agreement with experiment than in the case of CuI; this may be due to a more complex composition of the CuCl and CuBr bands.

535.3

9505. THEORY OF THE OPTICAL PROPERTIES OF BIAXIAL MAGNETIC CRYSTALS. F.I.Fedorov and L.M.Tomil'chik.
Optika i Spektrosk., Vol. 4, No. 1, 109-12 (Jan., 1958). In Russian. English summary: PB 141047T-3, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

A theoretical paper extending previous work. See Abstr. 9122-(1957); 932-3 (1958).

535.39 : 539.23

9506. DETERMINATION OF THE OPTICAL CONSTANTS OF VERY THIN LAYERS OF LEAD IN VACUUM AND IN AIR. J.Trompette.
C.R. Acad. Sci. (Paris), Vol. 248, No. 2, 207-9 (Jan. 12, 1959). In French.

The optical constants of freshly evaporated layers were deter-

mined in vacuo and then in air. The changes in optical constants caused by exposure to air appeared to be instantaneous, but the thickness of the layers was not affected by the oxidation.
B.T.M.Willis

535.392 : 535.87

9507. PHASE CHARACTERISTICS OF MULTILAYER DIELECTRIC MIRRORS. V.V.Sukhanovskii.
Optika i Spektrosk., Vol. 3, No. 1, 90-2 (July, 1957). In Russian.

The laws of phase change at multilayer mirrors were studied theoretically and experimentally. The treatment is based on results obtained earlier (Abstr. 8130 of 1956). The theoretical curves were found to agree well with the experimental points of the dependence of the phase-shift of a plane monochromatic wave falling on a two-component (ZnS and cryolite on a glass plate) multilayer dielectric mirror on the angle of incidence. Mirrors consisting of 5, 7, and 9 layers were considered. Good agreement between experiment and theory was also obtained for the phase shift dispersion (dependence on wavelength) of multilayer films with the same components (ZnS and cryolite). The experimental and theoretical phase-shift dispersion curves did not agree at 22 000-24 000 cm^{-1}, where both the refractive index and the absorption coefficient of ZnS increase sharply. These increases were not allowed for in theoretical calculations.
A.Tybulewicz

535.393

9508. A MODEL FOR INVESTIGATION OF THE OPTICAL PROPERTIES OF NOBLE METALS. M.Suffczyński.
Bull. Acad. Polon. Sci. Ser. Sci. math. astron. phys., Vol. 7, No. 3, 169-73 (1959).

The optical properties of metals with an absorption band in the visible part of the spectrum are predicted approximately on the basis of some simplifying assumptions regarding the shape of Fermi surfaces in a two-band model.
R.A.Weale

535.393

9509. OPTICAL PROPERTIES OF ZINC SULFIDE IN THE VACUUM ULTRAVIOLET. J.T.Cox, J.E.Waylonis and W.R.Hunter.
J. Opt. Soc. Amer., Vol. 49, No. 8, 807-10 (Aug., 1959).

The reflectance and optical constants of films of zinc sulphide vacuum deposited on to glass were measured for the wavelength region extending from 2200 to 584 A. The effects of different deposition conditions and ageing in normal and dry air were studied. In the wavelength range from 2200 to 1100 A the reflectance is relatively high (≅ 33%) and uniform. Beyond 1100 A it decreases and at 584 A is only 3.8%. The refractive index, n, decreases rapidly from a value of 3.13 at 2200 A to a minimum of 0.64 at 735 A. The absorption coefficient, k, has a maximum value of 1.75 at 1800 A and decreases with decreasing wavelength to a value of 0.23 at 584 A. In contrast to many other materials the variation of deposition conditions has very little effect on the reflectance of zinc sulphide. The films also show almost no ageing in normal or dry air. Under the best conditions these films are durable emough to stand washing with cotton and detergent many times without damage.

535.393

9510. STUDY OF THE OPTICAL PROPERTIES OF THIN [EVAPORATED] TRANSPARENT FILMS, IN CONNECTION WITH THEIR STRUCTURE. P.Bousquet.
Optica Acta, Vol. 3, No. 4, 153-60 (Dec., 1956). In French.

Spectrophotometric measurements have been made at normal and oblique incidence, with particular attention to the region of total reflection. The results show that the thin films studied have a much more complex structure than has generally been supposed. These films are not continuous, their granular structure giving rise to scattering of some of the incident light, which can result in a brilliant system of fringes in the region of total reflection; they are inhomogenous, showing refractive index gradients and transparent zones; they are sometimes anisotropic.

535.393 : 535.87

9511. ON THE METHOD OF MEASUREMENT OF THE SPECTRAL REFLECTION COEFFICIENT OF MIRRORS. R.B.Tagirov.
Optika i Spektrosk., Vol. 4, No. 2, 278-9 (Feb., 1958). In Russian.
English summary: PB 141047T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

An apparatus for measuring reflectivity of mirror coatings in the 1-25 μ region. A concave spherical mirror is coated with the material to be investigated and used to form a real image of a source in the same plane as the source and close to it. Another mirror system is used to focus either the source or this real image of it on the slit of an i.r. spectrophotometer and the spectral reflectivity is measured by substitution. No results are given.
W.T.Welford

535.393

9512. ACTION OF ULTRAVIOLET RADIATION ON METALLIC MIRRORS. M.K.Ivanova, T.N.Lomonosova and A.V.Yakovleva.
Optika i Spectrosk., Vol. 4, No. 4, 535-6 (April, 1958). In Russian.
English summary: PB 141047T-9 obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The authors measured the reflectivity of aluminium and rhodium mirrors in the Schumann region under the action of u.v. light in vacuum. The results show an improvement in reflectivity by irradiation in a reducing atmosphere. Some fluorides are also shown to lose their transparency under irradiation.
R.W.Fish

535.393 : 535.41

9513. REFLECTION OF LIGHT BY A SYSTEM OF THIN FILMS DEPOSITED ON AN OPAQUE METAL LAYER. M.A.Validov.
Optika i Spektrosk., Vol. 4, No. 5, 651-7 (1958). In Russian.
English summary : PB141047T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Formulae are given for the reflectance of multilayers consisting of alternate $\lambda/4$ layers of high and low refractive index materials, showing that better results are obtained when the total number of layers is odd. Numerical results are given for the pairs of materials MgF_2-ZnS and SiO_2-TiO_2. The increase in reflectance of Al and Ag films obtained by adding such multilayers is computed and compared with experimental results. All numerical results refer only to the wavelength at which the layers are exactly $\lambda/4$.
W.T.Welford

535.394

9514. ON THE EFFECT OF THIN FILMS ON THE TOTAL REFLECTION. P.G.Kard.
Optika i Spektrosk., Vol. 6, No. 4, 533-6 (April, 1959). In Russian.

The author discusses theoretically the effect of a transparent multilayer film, placed between two media, on the phase shift occurring on total (internal) reflection at the boundary between the two media. The basic recurrent formula is derived in a form suitable for numerical calculations. As an example the author gives calculations for single and double-layer films which minimize the phase-shift difference between the components polarized parallel and at right angles to the plane of incidence.
A.Tybulewicz

535.399 : 538.566.2 : 539.23

ELECTROMAGNETIC WAVE ABSORPTION IN THIN METALLIC FILMS. See Abstr. 8900-2

535.412

9515. ASYMMETRIC FRINGES IN MULTIPLE BEAM SYSTEMS. J.L.Farrands.
Optik, Vol. 16, No. 1, 14-18 (Jan., 1959).

The asymmetrical saw-tooth shape of interference fringes in a multiple beam system is discussed. It is shown that this can be produced to a controllable degree by the addition of a coherent wave of variable phase. Apparatus for doing this is described, and its importance in the understanding of lossy films is defined. Further importance in microwave interferometry is briefly stated.

535.417

9516. MICA INTERFERENCE FILTERS WITH TRANSMISSION BANDS OF VERY NARROW HALF-WIDTHS. J.A.Dobrowolski.
J. Opt. Soc. Amer., Vol. 49, No. 8, 794-806 (Aug., 1959).

Theoretical aspects, production methods, testing, and application of high-order interference filters are described which employ a thin sheet of mica in place of the usual evaporated dielectric spacer layer. Such filters have been made with half-widths less than 1 A and transmissions of up to 70%. In particular, details are given of the cleaving process, the double refraction and the absorption of mica. A filter mount is described which makes it possible to construct filters of practical size. Measurements are reported on the uniformity of transmission peaks over the 4 cm diameter area of the filters. Theoretical and experimental values are given for the angular field. Other properties discussed are the effect of the filters on resolving power, the background, the spectral region for which they can be constructed and the stability of mica filters with time and with temperature changes. A narrow band filter is described. Another filter described was designed to transmit the 5896 A and reject the 5890 A line of sodium. A third filter rejects all the lines of the krypton spectrum except the 6056 A line which was recommended as the primary standard of length.

535.417

9517. EFFECT OF NATURAL LINE WIDTH ON RESOLVING POWER OF FABRY PEROT ETALON. M.S.Sodha and S.S.Mitra.
Optik, Vol. 15, No. 1, 47-50 (Jan., 1958).

Discusses the effect of natural line width due to Doppler effect and resonance damping on the resolving power of Fabry—Perot etalon. It has been assumed, as a first approximation, that the natural line width does not affect the nature of the intensity pattern. A table is given to show the variation.

535.417

9518. NEW ASPECTS OF INTERFERENCE SPECTROSCOPY.
H.J.J.Braddick.
Sci. Progr., Vol. 47, 278-86 (April, 1959).

A survey of recent visibility methods of interference microscopy using variations in the performances of instruments and their dependence on aperture and source are reviewed. A survey of multilayers for the ultraviolet and infrared is included. Scanning interferometers are reviewed. S.Tolansky

535.42

9519. CHANGE IN THE DISTRIBUTION OF LIGHT ENERGY IN A DIFFRACTION IMAGE BY MEANS OF FILTERS OF VARIABLE TRANSPARENCY. G.G.Slyusarev and N.I.Kulikovskaya.
Optika i Spektrosk., Vol. 4, No. 4, 486-93 (April, 1958). In Russian. English summary: PB 141047T-9, obtainable from Office of Technical Services, U.S.Dept. of Commerce, Washington, D.C.,U.S.A.

Filters of variable transmission placed in the plane of the pupil may be used to weaken secondary maxima in diffraction images or to reduce the size of the central maximum, though calculation shows these objectives to be mutually exclusive. Filter design is described, and the improvement produced is shown graphically.
S.T.Henderson

535.421

9520. ASTIGMATISM OF THE CONCAVE GRATING WITH SPHERICAL OR TOROIDAL SURFACES. H.Greiner and E.Schäffer.
Optik, Vol. 16, No. 5, 288-303 (May, 1959). In German.

For two wavelengths it is possible to form a stigmatic image using a concave grating with a toroidal surface. A procedure is described by means of which the ratio of the radii of curvature of the toroidal surface and the angle of incidence can be determined such that the departure from a stigmatic image formation is a minimum over a given range of angles (range of wavelengths). The density distribution of the incident light along a spectral line is examined for a toroidal grating, the case of the spherical grating being a special case. The toroidal and the spherical grating are compared with reference to the incident light density (in a spectrograph), or the radiant flux leaving the exit slit (in a spectrometer), respectively. Whether there is a gain in the density of incident light, or radiant flux through the exit slit, depends essentially on the length of the entrance and exit slits which it is feasible to use under the given experimental conditions.

535.421

9521. TEST RESULTS ON A HIGH-INTENSITY BLAZED DIFFRACTION GRATING. W.Mattig and E.H.Schröter.
Optik, Vol. 16, No. 6, 339-49 (June, 1959). In German.

A grating manufactured by the Optical Institute in Leningrad (area 100 mm × 90 mm; line density 600 per mm) was put through a performance test prior to its use in the Einstein tower in Potsdam. The test results were as follows. The theoretical resolving power is nearly reached up to the 6th order. The intensity of the first Rowland ghost amounts to about 0.3% in the 2nd order, and to about 2% in the 6th order. In general, the amount of scattered light is very small. It can be inferred from the measured intensity distribution of the spectrum that the groove-profile ought to be triangular. The observed intensity distribution is in good agreement with the blaze of this grating. The observed, insignificant focal property of the plane grating is discussed.

535.421

9522. ON THE INCREASE OF THE RESOLVING POWER OF OPTICAL SYSTEMS. K.D.Sinel'nikov and A.N.Ryazanov.
Optika i Spektrosk., Vol. 5, No. 2, 184-90 (1958). In Russian. English summary : PB141047T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The authors discuss objectives formed by a series of slits, ruled in an opaque layer of aluminium. Intensities may be controlled by the width of the slit, phase by evaporating a ZnS layer over the slit. The diffraction images for a variety of slit arrangements are calculated, and it is shown that an objective containing three pairs of slits has greater resolving power than a circular objective. A new criterion of resolving power is proposed.
R.W.Fish

535.423

9523. FRESNEL DIFFRACTION FROM A NARROW SCREEN, A SLIT AND A SEMI-PLANE FOR A NON-SPHERICAL WAVE.
V.S.Sukhorukikh.
Optika i Spektrosk., Vol. 6, No. 4, 523-7 (April, 1959). In Russian.

The first section derives Fresnel diffraction formulae for a narrow screen, a slit and a semi-plane for waves whose fronts are close in shape to an elliptical or a hyperbolic paraboloid or a parabolic cylinder. The problem is solved using the usual approximate methods of Huygens. The second section describes an experimental verification of the Fresnel diffraction formula for cylindrical waves
A.Tybulewicz

535.428

9524. POLARIZATION OF LIGHT BETWEEN 100μ AND 300μ BY ECHELETTE GRATINGS. A.Hadni, E.Décamps and P.Delorme.
J. Phys. Radium, Vol. 19, No. 10, 793-4 (Oct., 1958). In French.

An echelette grating of zero order has been used as a filter for work in the far infrared. The light reflected by the filter is strongl polarized with its vibration direction perpendicular to the lines, and the light from the principal grating is polarized parallel to the lines For spectral orders greater than unity the visible light dispersed in the blaze was not polarized. H.G.Jerrard

535.4

9525. SPECTRAL STUDIES OF LIGHT SCATTERED BY VISCOU LIQUIDS AND AMORPHOUS SOLIDS.
V.K.Ablekov and I.L.Fabelinskii.
Dokl. Akad. Nauk SSSR, Vol. 125, No. 2, 297-9 (1959). In Russian.

Describes studies of scattering of visible light (4358 A) in triacetin in liquid and amorphous solid states. The spectral composition of the scattered light, the spectral distribution of depolarization and changes in these quantities on transition from liquid to amorphous solid states were determined in order to test prediction of the theories of scattering (a) in liquids and (b) in crystalline solids. Theory (a) gave better agreement with the results, especial when it was supplemented by Rytov's (Abstr. 1632-3 of 1958) correlation theory. A.Tybulewicz

535.43.0

9526. POLAR SPECTROHYDRONEPHELOMETER.
V.B.Veinberg, N.M.Dul'neva, P.N.Meingard and V.L.Yakovenko.
Dokl. Akad. Nauk SSSR, Vol. 121, No. 4, 634-6 (1958). In Russian.

Illustrated description of a polar hydronephelometer and transparency meter designed and built in 1956. It consists of a cuvette with the analysed water in which the objectives of the illuminating and of the photometric devices are immersed. The brightness of the milky-glass field of comparison of the photometer can be varied within the range $1/10^6$. The apparatus enables either the absorption or diffusion of light by water to be measured. A few results of measurements carried out with seawater are graphed an described. F.Lachma

535.43

9527. LIGHT SCATTERING FUNCTIONS FOR SPHERICAL PARTICLES WITH $m = 1.75$.
E.J.Meehan and W.H.Beattie.
J. Opt. Soc. Amer., Vol. 49, No. 7, 735 (July, 1959).

Light scattering coefficients and angular scattering functions for particles having a relative refractive index of 1.75 have been calculated from the Mie theory and are tabulated. The scattering functions were checked to three significant figures by Van de Hulst's method of phase angles. H.G.Jerrar

535.4

9528. TRANSMISSION OF LIGHT THROUGH MULTIPLY SCATTERING DISPERSIONS OF LATEX WITH A PARTIALLY REFLECTING BOUNDARY. P.H.Scott and S.W.Churchill.
J. phys. Chem., Vol. 62, No. 10, 1300-2 (Oct., 1958).

The transmission of light by a multiply scattering dispersion with a partially reflecting boundary was investigated experimental The dispersion consisted of a suspension of 0.814 μ spheres of pol styrene latex in an aqueous solution of 54.6 wt. % glycol. The dispersion was illuminated from above by a neon glow lamp immers in heptane to avoid an optical discontinuity at the interface of the dispersion and was bounded below by removable surfaces with lbedos of 6, 70 and 90%. The reception in the plane of the reflecting urface was measured with a 2π-receiver for tangents of the azimuth ngle of the source with respect to the normal to the reflecting sur- ace ranging from 0 to 13.6, and for dispersion thicknesses of 2.15, .26 and 6.35 mean free paths for scattering. Essentially mono- hromatic measurements were obtained at a wavelength of 0.427 μ in ne glycol solution. At this wavelength the latex particles are non- bsorbing and have an index of refraction of 1.157 with respect to the lycol solution. Boundary reflection was found to increase the light triking the boundary by 10 to 25% over the range of conditions nvestigated. The results are in reasonable agreement with the heoretical results of Chu, Clark and Churchill [J. phys. Chem., ol. 61, 1303 (1957)].

535.434

529. ON THE INTENSITY OF LIGHT SCATTERED BY FINE ARTICLES.
K.Kubo.

. Sci. Res. Inst. (Tokyo), Vol.50, 10-18 (March, 1956).

The behaviour of light-scattering, varying with particle concen- ration, is studied on the basis of multiple scattering. The angular ntensity distribution is represented by Legendre's polynomial series nd successively determined from the fluxes of scattered light.

535.435 : 532.77

530. RAYLEIGH SCATTERING OF LIGHT BY SOLUTIONS IN HE ABSORPTION-BAND REGION.
L.N.Ovander.

ptika i Spektrosk., Vol. 3, No. 3, 221-6 (Sept., 1957). In Russian.

The author considers the case when the incident-light frequency es in the absorption band. The quantum-mechanical state of the ystem is described by three quantum numbers representing the tate of a molecule, state of the solvent, and radiation field respect- vely. It is shown that the Rayleigh scattering intensity varies with he frequency of the incident light and is proportional to the ordinate f absorption spectrum. The spectral form of scattered lines is lentical with that of the incident light. Scattering in the absorption- and region is subject to impurity and temperature quenching.

A.Tybulewicz

535.51

531. ON THE COMPOSITE POLARIZATION OF LIGHT.
.G.Fesenkov.

stron. Zh., Vol. 35, No. 5, 681-6 (1958). In Russian.

The author considers two sources viewed simultaneously. hey are polarized in different ways and the paper derives xpressions for the composite polarization properties of the two ources together, in terms of the properties of the separate sources.

535.51

532. INFRARED POLARIZATION FILTERS.
G.I.Distler.

ptika i Spektrosk., Vol. 5, No. 2, 219 (1958). In Russian. English ummary: PB 141047T-5, obtainable from Office of Technical ervices, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Transmission curves for both polarizations are given for three ew kinds of polarizer of the polaroid type, effective respectively rom 0.75 to 2 μ, 0.75 to 2.4 μ and 0.75 to 3.0 μ, and having trans- nissions of approximately 40, 30 and 25%. No details of their nethod of preparation are given.

W.T.Welford

535.514.2

533. POLARIZATION OF LIGHT AT ALUMINIZED [GLASS-] COELOSTAT MIRRORS.
G.Ruben.

Optik, Vol. 16, No. 6, 326-38 (June, 1959). In German.

The elliptic polarization of the light reflected from these nirrors, some of them having oxide layers of varying thicknesses, vas determined monochromatically by measuring the phase shift and he relative reflectivity for linearly polarized light at various angles f incidence. Owing to the oxide layer, the results differ essentially rom the theoretical values for metallic reflection. The entire in- trumental polarization of a tower telescope can be computed by com- ining the effects of three successive reflections.

535.514.3

534. SPECTRO-POLARIZATION CHARACTERISTICS OF THE ODIUM NITRATE POLARIZER.
.Yamaguti, I.Makino, S.Shinoda and I.Kuroha.

. Phys. Soc. Japan, Vol. 14, No. 2, 199-201 (Feb., 1959).

The polarization characteristics of a sodium nitrate polarization rism are measured. The polarization effect is complete from 50 to 1000 mμ; and transmission of light, uncorrected for reflection at the surfaces, is about 90% at above 400 mμ and 37% at 350 mμ. The possibility of making a polarization prism for a wide wavelength range from 250 to 1000 mμ is discussed.

535.56

9535. OPTICAL ACTIVITY WITH THE NON-LINEAR EFFECT OF "SATURATION" TAKEN INTO ACCOUNT.
V.L.German and É.A.Kaner.

Optika i Spektrosk., Vol. 3, No. 1, 68-72 (July, 1957). In Russian.

The authors show that near resonance a medium becomes non-linear and its optical properties depend on the amplitude of the external field. These optical properties are shown to include optical activity and circular dichroism. Since the authors do not specify the frequency region in their work it is in principle possible to apply these results to non-linear effects near resonance in any frequency region.

A.Tybulewicz

535.64

9536. THE EXPONENTIAL FUNCTION FOR THE UNIFORM CHROMATICITY SCALE.
R.Taguti and M.Sato.

Acta electronica, Vol. 2, No. 1-2, 316-18 (1957-58).

"Physical problems of colour television". Conference paper (see Abstr. 1006 of 1958). A uniform chromaticity scale based on a logarithmic relation between the Munsell value and relative reflectance shows "fairly" good agreement for the locus of constant hue and chroma in the C.I.E. diagram.

R.A.Weale

535.64

9537. A MEASURE FOR THE TOTAL DIFFERENCE OF TWO SETS OF COLOR-MIXTURE FUNCTIONS.
G.Wyszecki.

J. Opt. Soc. Amer., Vol. 49, No. 8, 811-14 (Aug., 1959).

Using a large number of specially selected imaginary object colours which are metameric with respect to one set of colour-mixture functions, the spatial distribution of these colours with respect to the other set of colour-mixture functions provides an illustrative means of measuring the total difference of the two sets of colour-mixture functions. The spatial distribution follows a normal trivariate distribution law which allows the computation of an ellipsoid that is expected to contain 95% of all theoretically and practically possible object colours of the same class used to calculate that ellipsoid. A numerical example involving the colour-mixture functions of the 1931 CIE standard observer and the colour-mixture functions derived from the Stiles 10° pilot data demonstrates the theory.

535.642

9538. ACCURACY OF TRISTIMULUS COMPUTATIONS.
J.L.F. De Kerf.

J. Opt. Soc. Amer., Vol. 49, No. 1, 102 (Jan., 1959).

Errors in tables on which tristimulus computations were based (see Abstr. 3012 of 1958) are too small to affect the conclusions then reached.

R.A.Weale

535.7

PHYSIOLOGICAL OPTICS. VISION. See also the Section entitled "BIOPHYSICS. PHYSIOLOGICAL PHYSICS".

535.7 : 537.312.5

THE EXCITATION SPECTRA OF PHOTOCONDUCTIVITY AND LUMINESCENCE FOR CdS CRYSTALS. See Abstr. 8154

535.81

9539. DEVICE FOR THE SIMULTANEOUS OBSERVATION AND COAXIAL ILLUMINATION OF VERY NARROW CAVITIES.
H.J.Adler.

J. Opt. Soc. Amer., Vol. 49, No. 1, 102 (Jan., 1959).

A Lummer—Brodhun type cube with very small transmitting and large reflecting areas is used. One face is convex and this together with other faces forms a condenser for illuminating and a low power Galilean telescope for viewing.

W.T.Welford

535.822.6

9540. CHARACTERISTICS OF THE BASIC METHODS OF OBSERVATION IN POLARIZATION MICROSCOPY.
R.Mosebach.

Z. wiss. Mikr., Vol. 63, No. 2, 72-85 (Sept., 1956). In German.

Elementary description of the optical principles and discussion of nomenclature.

W.T.Welford

535.822.9

9541. THE THREE-DIMENSIONAL OR SOLID-IMAGE MICROSCOPE.
W.D.Jackson.

Nature (London), Vol. 183, 1048-9 (April 11, 1959).

Solid image microscopes have been described previously in which object and viewing screen vibrate in synchronism. The present note describes a simple apparatus in which the object alone vibrates at 50 c/s, allowing a greatly increased depth of field at high magnifications. The brightness of the lamp has to be modulated to ensure uniform brightness throughout the depth of field. Good definition over 15 μ is claimed with an oil immersion objective working at a magnification of ×1000. R.W.Fish

535.826.3

9542. ULTRAMICROTOME OF SIMPLE CONSTRUCTION.

M.von Ardenne and H.Westmeyer.

Optik, Vol. 16, No. 4, 193-9 (April, 1959). In German.

An ultramicrotome with a thermal specimen feed is described, in which the movable specimen stage is joined to the base plate by means of a crossed-spring pivot. The thickness of the cut is measured by means of a triple-ray interference method, and is of the order of 0.01 μ. The mechanical feed to the knife is constructed with sufficient precision to enable sections of the order of 1 μ to be made without recourse to further aids. This facilitates the selection of the most suitable position of the section on the specimen.

535.832

9543. DERIVATION OF A FORMULA FOR THE SPECIFICATION OF THE RECIPROCAL RELATIVE DISPERSION OF OPTHALMIC MULTIFOCAL SEGMENT GLASSES.

D.B.Whitney.

J. Opt. Soc. Amer., Vol. 49, No. 5, 490-1 (May, 1959).

The dispersion of the glass used for the reading segment is specified in terms of its refractive index in a new American Standard. This is based upon a residual chromatic aberration of 0.06 diopter. A graph shows the performance of 18 typical optical glasses as judged by this requirement. R.W.Fish

535.89

9544. A FAST REPETITION RATE FLASH LAMP.

G.D.Salamandra, I.M.Naboko and I.K.Sevast'yanova.

Pribory i Tekh. Eksper., 1959, No. 2, 124-7 (March-April). In Russian.

Describes and illustrates the construction of two new types of demountable point and line flash sources, filled with hydrogen at 1 atm, operating at 25 kV, and with a continuous spectrum in the range 4000-6500 A. Filming rates of up to 100 000-150 000 exposures per sec are attainable, the exposure time being not greater than 5×10^{-7} sec. Photography of an explosive mixture flame front with the aid of the flash lamp is also described and illustrated, and the necessary synchronization circuit is discussed. D.E.Brown

535.89 : 621.325.122.9

9545. GENERATOR OF NANOSECOND LIGHT PULSES FOR PHOTOTUBE TESTING.

Q.A.Kerns, F.A.Kirsten and G.C.Cox.

Rev. sci. Instrum., Vol. 30, No. 1, 31-6 (Jan., 1959).

This mercury-capsule light-pulse generator was developed to test and evaluate the high-speed features of multiplier phototubes and low-level image tubes. Light pulses and electrical trigger pulses are generated simultaneously in an arc discharge at a usual repetition rate of 60 per sec. The electrical pulse is used as a time reference for the light pulse. The time required for both the light and the electrical pulse to rise from 10 to 90% of peak amplitude is less than 5×10^{-10} sec. The light pulse rises to a maximum and falls to 50% peak amplitude in less than 1.5×10^{-9} sec. The electrical pulse power available is large. Time resolution of 10^{-10} sec is typical of measurements made with conventional fast oscilloscopes, while elaboration of technique permits relative time measurements that are better in some cases by at least three orders of magnitude. The light is emitted from a region a few mils in diameter, and thus may often be considered to come from a point source. An S4 photosurface subtending 0.1 sterad at the light source emits photoelectrically about 10^7 electrons per sterad per pulse. For convenience, three decoupled electrical output channels are provided, together with a Polaroid attenuator for the light pulse.

HEAT

536.2 : 517.9

TEMPERATURE DISTRIBUTION IN A CYLINDER. See Abstr. 9128

536.2.02

9546. THE INTEGRATION OF THE HEAT TRANSPORT EQUATION WHEN THE PHYSICAL PROPERTIES DEPEND STRONGLY ON TEMPERATURE. APPLICATION TO DIFFUSION.

P.Vernotte.

C.R. Acad. Sci. (Paris), Vol. 248, No. 3, 378-80 (Jan. 19, 1959). In French.

The problem of the transport of heat from a very hot gas to a cold wall has been studied by means of certain divergent series. It is asserted that the classical formula for constant conductivity can be applied by taking the conductivity to be that corresponding to an absolute temperature about $\frac{7}{10}$ that of the main body of the gas. J.Hawgood

536.21

9547. SOME PROBLEMS ON HEAT CONDUCTION IN STRATIFORM BODIES.

V.Vodička.

J. Phys. Soc. Japan, Vol. 14, No. 2, 216-24 (Feb., 1959).

536.212

9548. THEORY OF THE A.F.JOFFE [IOFFE] METHOD FOR RAPID MEASUREMENT OF THE THERMAL CONDUCTIVITY OF SOLIDS.

W.F.G.Swann.

J. Franklin Inst., Vol. 267, No. 5, 364-80 (May, 1959).

The method (Abstr. 9652 of 1957) utilizes a block B of high thermal conductivity fastened to the specimen S of length l and parallel to the x-axis, and of lower conductivity k. Both B and S are initially at the same temperature. The free end of S ($x = l$) is suddenly raised at $t = 0$ to the temperature τ_∞ and maintained there. The general problem is to determine θ, the excess temperature above τ_∞ at the point x, as a function of x and t. From the solution the thermal conductivity of S is obtained in terms of the temperature—time relationship for B and the dimensions and other parameters of the system. The simple theory, assuming θ at $x = 0$ decreases so slowly with time that the temperature gradient in S is θ/l, leads to $\theta = \theta_0 \exp(-kt/Msl)$, where θ_0 is the initial value of θ; M is the mass of B divided by the area of its junction with S; and s is the specific heat of B. The more exact theory gives

$$\theta = \sum_{0}^{\infty} A_s \exp(-\lambda_s t)[\cos \Psi_s x l^{-1} - G_x \Psi_s \sin \Psi_s x l^{-1}],$$

where the constants A_s are such that $\theta = \theta_0$ at $t = 0$; Ψ_s is a solution of $G_s \Psi_s \tan \Psi_s = 1$ where G_s is a constant function of s dependent on the boundary conditions at $x = 0$; and $\lambda_s = \Psi_s^2 (kR/Msl)$ where R is the ratio of the thermal capacities of S and B. The case where the thermal resistance at $x = 0$ is negligible is fully treated. S.Weintroub

536.212

9549. PULSED MEASUREMENT OF THE VARIATION OF THERMAL CONDUCTIVITY OF GERMANIUM WITH TEMPERATURE.

J.I.Pankove.

Rev. sci. Instrum., Vol. 30, No. 6, 495-6 (June, 1959).

The experimental set-up is shown diagrammatically. The specimen is a cylinder, 30 mils diameter and 100 mils long, which is soldered at its lower end to a Cu heat sink and heated at its upper end by touching a C filament which is heated by a 3 sec pulse of current. The temperature distribution along the specimen is measured by a movable chromel—alumel thermocouple attached to a recorder. Relative values of the conductivity as a function of temperature are obtained. Data obtained for a number of nearly intrinsic n-type single crystal specimens between 700 and 100°C are shown graphically. S.Weintroub

536.212.2 : 537.311.31

THERMAL CONDUCTIVITY OF PLUTONIUM. See Abstr. 8091

536.23 : 537.56

THERMAL CONDUCTIVITY OF A PLASMA. See Abstr. 8254

536.23 : 539.19

CALCULATION OF INTERMOLECULAR FORCE CONSTANTS F GASES FROM THERMAL CONDUCTIVITY VARIATIONS WITH EMPERATURE. See Abstr. 8764

536.244

550. THERMAL CONDUCTIVITY OF POWDERS. M.J.Laubitz.
anad. J. Phys., Vol. 37, No. 7, 798-808 (July, 1959).

The effective thermal conductivity of several powders of easonably uniform particle size, and one powder of graded particle ize, was measured in the temperature range of 100°to 1000°C. Most f the results can be very satisfactorily explained by assuming that he effective conductivity of the powder is composed of two parts, he first part being a two-phase gas—solid conductivity, and the econd an equivalent radiation conductivity.

536.3 : 535.232

SPECTRAL EMISSIVITY OF SOLIDS IN THE INFRARED AT OW TEMPERATURES. See Abstr. 9367

536.3 : 535.232

SPECTRAL EMISSIVITY OF CARBON DIOXIDE FROM 800-2500 cm^{-1}. See Abstr. 9368

536.33.08 : 535.33.07

551. ON THE RESPONSE OF A SELECTIVE PNEUMATIC ETECTOR. K.Mori.
. Sci. Res. Inst. (Tokyo), Vol. 49, 290-302 (Dec., 1955).

The detector consists of a heat cell, containing a gas which selectively absorbs incident radiation. Its temperature rise increases the pressure which is transmitted to a sensitive microphone. The incident radiation is chopped, so that the microphone output can be conveniently amplified. The performance of the system s determined from the cell dimensions, type of gas, the gas constants, chopping frequency etc. Curves are given illustrating the erformance to be expected from changes in the parameters. R.W.Fish

536.413

552. ON THE THERMAL EXPANSION OF SOLIDS.
.Takahashi.
hysica, Vol. 24, No. 11, 857-67 (Nov., 1958).

It is pointed out that the thermal expansion coefficient of solids s not always zero even in ideally harmonic crystals, if one uantizes the phonon field. This apparently differs from the customary treatment which is essentially based on non-quantized phonon ield model. The present discussion, which starts with a quantized honon model, is compatible with the phenomenological treatment by Born and Huang and by Slater. This fact would clarify the source of he factor 1/3 in Slater's Grüneisen constant pointed out by Dugdale nd MacDonald.

536.413 : 539.32

THERMAL EXPANSION OF CEMENTITE. See Abstr. 8923

536.421.4

9553. PROBABILITY OF FREEZING. A.E.Carte.
Proc. Phys. Soc., Vol. 73, Pt 2, 324 (Feb., 1959).

The relations between the volume, duration and depth of supercooling, and the probability of freezing, obtained by Bigg (Abstr. 401 f 1954), are derived in a more straightforward way. S.Weintroub

536.423 : 532.14

TEMPERATURE VARIATION OF ORTHOBARIC DENSITY IFFERENCE IN LIQUID—VAPOUR SYSTEMS. See Abstr. 9283

536.423.15

9554. DIFFUSION EFFECTS IN THE TRANSPIRATION METHOD F VAPOR PRESSURE MEASUREMENT. U.Merten.
. phys. Chem., Vol. 63, No. 3, 443-5 (March, 1959).

With the transpiration technique for the determination of vapour ressures it is possible to work even at flow rates where diffusion s negligible provided only that data can be obtained at two significantly different flow rates where saturation is achieved. When saturation is not achieved, p_1, the pressure at the inlet of the flow resistance which separates the sample from the condensation region, will be a function of the sample surface area. The calculation of p_1 from experimental data requires knowledge of the molecular weight M of the vapour species. R.Schnurmann

536.424.1

9555. THEORY OF PHASE TRANSITIONS IN SOLID HEAVY METHANE. H.M.James and T.A.Keenan.
J. chem. Phys., Vol. 31, No. 1, 12-41 (July, 1959).

The authors explain the existence of three solid phases in CD_4, and predict the molecular ordering in each phase, by straightforward deduction from a reasonable assumption concerning the orientational coupling of the molecules. Molecular and lattice variations are neglected, the crystal being treated as an f.c.c. array of spherical rotators carrying distributions of charge with tetrahedral symmetry. It is assumed that the dominant term in the orientational coupling of the molecules is their electrostatic interaction, of which only the octopole—octopole interaction of next neighbours is retained in the calculation. The magnitude of the effective octopole moment is the only disposable constant in the theory. The statistical calculation is based on a classical version of the self-consistent field idea; neglect of quantum effects makes the results inapplicable to CH_4, which shows large isotope differences from CD_4. The conditions for self-consistency in the theory appear as a family of integro-functional equations, one for each molecule in the crystal. These are brought into convenient form by introduction of tetrahedral harmonics and associated tetrahedral rotator functions. The consistency equations are first solved for the cases in which the orientational distribution function is the same for all molecules in the crystal. There exist three distinct solutions of this type, in which all molecules are subject to identical orienting fields with symmetries T, C_2, or D_3, respectively. More general solutions are then found, for which the molecules are not all equivalent, but may be freely rotating, or in orienting fields of symmetry T, C_2, or D_3. The consistency relations state restrictions on the distribution of such molecules in the crystal lattice, and fix the strengths of the orienting fields; they can be satisfied only for small numbers of molecules in a crystal cell. An apparently exhaustive tabulation is made of all solutions with low free energy. Three of these minimize F in some temperature range, and describe stable phases. At the lowest temperatures the stable phase has tetragonal symmetry V_d, with all molecules oscillating about equivalent equilibrium orientations. As T rises this undergoes a first-order transformation to a phase with octahedral symmetry O, in which one molecule in four rotates freely, surrounded by a shell of oscillating next neighbours. At higher temperatures this undergoes a transformation (described by the theory as of second order) to an orientationally disordered phase. If the molecular octopole moment is assigned the magnitude 0.504×10^{-24} electron cm^3 needed to make the predicted upper transition temperature agree with the 27.1°K observed in CD_4, the predicted lower transition temperature is 24.4°K, as against the observed 22.2°K. Predictions of the theory are also in satisfactory agreement with observations on integrated heats of transition, zero-point entropy, and the optical properties of the phases.

536.424.1

9556. THE POLYMORPHIC TRANSFORMATION OF LEAD SULPHATE AND OF MIXED CRYSTALS OF LEAD-SULPHATE—BARIUM-SULPHATE. J.Jaffray.
J. Phys. Radium, Vol. 19, No. 6, 614 (June, 1958). In French.

Lead sulphate changes on heating from orthorhombic to monoclinic at 866°C; a mixture with 25% $BaSO_4$ changes at 910°C, as shown by thermal analysis. Results could not be obtained for higher percentages of $BaSO_4$ because of instability. A.R.Stokes

536.44 : 534.22

9557. AN INVESTIGATION OF THE CRITICAL STATE BY ULTRASONICS. H.Tanneberger.
Z. Phys., Vol. 153, No. 4, 445-57 (1959). In German.

An improved form of the apparatus described in Abstr. 8105 (1954) was used to measure the velocity of ultrasonic wave propagation in CO_2 and ethane, in the neighbourhood of their critical points. Details are given of the methods of measurement of the temperature, pressure and density, and of the interferometer. The results are shown graphically. For ethane, isochores of the velocity as a function of temperature (28°-40°C approx.) and isotherms of the velocity as a function of density (100-200 Amagat units) are plotted and the variation of specific heat at constant volume, calculated from the velocity values, is also shown. S.Weintroub

536.441 : 532.61

SURFACE TENSION OF LIQUIDS AT THE CRITICAL POINT. See Abstr. 9296

536.483

9558. HYDROGEN LIQUEFACTION. D.H.Bowen.
Nature (London), Vol. 183, 1504-6 (May 30, 1959).

Report of a one-day symposium on "Hydrogen Liquefaction and Associated Techniques" organized by the Low Temperature Group of the Physical Society and held in London on March 12, 1959. Some nine papers are summarized, the topics being: research applications, small-scale liquefiers, production of low-energy neutron beams, use of the liquid as a target for scattering experiments with high energy particles, rocket fuels, extra large-scale production (2 tons/hour), storage and ortho-para conversion problems, large-scale storage, and safety precautions. L.Mackinnon

536.483 : 535.33.07

METHODS AND APPARATUS FOR OPTICAL AND SPECTRAL STUDIES AT LOW TEMPERATURES. See Abstr. 9398

536.5 : 537.324

9559. A METHOD FOR REMOVING HEAT FROM SEMICONDUCTOR COOLING DEVICES.
E.A.Kolenko, A.G.Shcherbina and V.G.Yur'ev.
Zh. tekh. Fiz., Vol. 28, No. 11, 2543-5 (1958). In Russian.

The output from the hot junctions of the thermoelectric pairs is absorbed in the latent heat of melting of a suitable substance. A list of the latent heats of potentially useful substances is given (melting points 45°-65°C). Using 300 cm^3 of Wood's metal it was possible to maintain the temperature of a cooled volume at ~ 25 deg C below its surroundings for ~ 3 hr. K.F.Hulme

536.5.081

9560. ON THE TEMPERATURE SCALE IN THE LIQUID ^{4}He REGION. H. van Dijk and M.Durieux.
Physica, Vol. 24, No. 11, 920-30 (Nov., 1958).

The new temperature scale proposed at the 1958 Kamerlingh Onnes Conference is recommended for use instead of the two scales, T_{55E} and T_{L55}, which have been used since 1955. Apart from information obtained with gas thermometers, with interpolation thermometers and from information on thermodynamic quantities of helium used for the former scales, new results of magnetic measurements are available. The way in which the results have been used for the scale is briefly discussed.

536.52

9561. PHOTOGRAPHIC PYROMETRY WITH A COLOR-SEPARATION CAMERA. F.S.Simmons and A.G.DeBell.
J. Opt. Soc. Amer., Vol. 49, No. 7, 735-6 (July, 1959).

In research on rocket flames, there is a need to study emissivity at a number of wavelengths. A colour-separation camera has been adapted for use with a photographic pyrometer. The performance was found to be satisfactory by measurement of the temperature of a black body. Each colour photograph gave a temperature within a few degrees of that indicated by an optical pyrometer. R.W.Fish

536.531 : 621.317.733

9562. USE OF A DIRECT CURRENT AMPLIFIER AND RECORDER TO BALANCE A MUELLER RESISTANCE BRIDGE.
G.T.Armstrong, P.K.Wong and L.A.Krieger.
Rev. sci. Instrum., Vol. 30, No. 5, 339-43 (May, 1959).

By taking corrective action for electrical noise resulting from alternating current pickup and induced electrostatic charges, it has been possible to use a commercially available high gain d.c. amplifier and a recorder to balance a G-3 Mueller resistance bridge. Noise levels below 0.01 μV peak to peak were observed with a response time ~ 5 sec. Using a 25 ohm platinum resistance thermometer and 1 mA thermometer current, a precision of 0.0001°C was obtained in temperature measurement. The permanent and continuous record provided offers advantages over the ordinary optical galvanometer for the observation of time-dependent phenomena and the study of sources of error.

536.55

9563. LOW-TEMPERATURE THERMAL NOISE THERMOMETER.
E.T.Patronis, Jr, H.Marshak, C.A.Reynolds, V.L.Sailor and F.J.Shore.
Rev. sci. Instrum., Vol. 30, No. 7, 578-80 (July, 1959).

The design for a relatively simple noise thermometer for use at low temperatures is presented. This thermometer was used to measure temperatures as low as the lambda point of liquid helium with a least accuracy of 10%. Some of the properties of thermal noise are discussed.

536.55 : 535.33.07

DETERMINATION OF TEMPERATURE VARIATIONS IN A VERY HIGH PRESSURE MERCURY LAMP. See Abstr. 9395

536.581 : 621.316.74

9564. THERMOSTAT CONTROL BY RESISTANCE THERMOMETER. J.J.Zwolenik, J.E.Lind, Jr and R.M.Fuoss.
Rev. sci. Instrum., Vol. 30, No. 7, 575-6 (July, 1959).

By intercepting on a selenium cell part of the light beam from the galvanometer in the bridge circuit of the resistance thermometer used to measure bath temperature, a signal is obtained which is used to trigger a photorelay via a secondary galvanometer. The photorelay controls the heating current in the thermostat. Design of the selenium cell mounting and accompanying circuits are described. The device holds a 50 gal thermostat to 25° within a hunting amplitude of 0.002°C.

536.62

9565. A CALORIMETRIC MEASUREMENT OF THE HEATS OF SOLUTION OF THE INERT GASES IN WATER. D.M.Alexander.
J. phys. Chem., Vol. 63, No. 6, 994-5 (June, 1959).

A microcalorimeter is described which has been used to measure heats of solution of inert gases in water. Calorimetric values in kcal/mole of the standard enthalpies of solution of neon, argon, krypton and xenon are at 25°, −1.4 ± 0.4, −2.9 ± 0.2, −3.8 ± 0.2 and −4.1 ± 0.2, respectively.

536.628.2

9566. LOW-TEMPERATURE ADIABATIC CALORIMETER WITH AUTOMATIC SHIELD CONTROL.
W.J.Cooper, R.H.Forsyth, J.F.Masi and R.E.Pabst.
Rev. sci. Instrum., Vol. 30, No. 7, 557-9 (July, 1959).

The design and operation of an adiabatic low-temperature calorimeter employing a somewhat different design of automatic shield control is described. Thermocouple difference is sensed by a d.c. μV amplifier, which followed in the circuit by a recorder-controller and a control unit. The output of the latter is used to control the voltage across the shield heaters through a saturable reactor. This design has been used successfully with a conventional low-temperature adiabatic calorimeter (50 ml sample size). In most cases the recorder showed no variation from zero (±0.002 deg) during heating and equilibrating periods, while momentary disturbance at "on" and "off" was less than 0.05 deg.

536.631

9567. SPECIFIC HEATS OF COPPER FERRITE.
T.Inoue and S.Iida.
J. Phys. Soc. Japan, Vol. 13, No. 6, 656 (June, 1958).

The specific heat of $CuFe_2O_4$ has been determined from 100 to 600°C. There is one peak in the specific heat v. temperature curve at 390°C, corresponding to the cubic–tetragonal transition, and a second at about 470°C, corresponding to the magnetic transition. R.F.S.Hearmon

536.631

9568. LOW-TEMPERATURE HEAT CAPACITIES AND THERMODYNAMIC PROPERTIES OF ZINC FERRITES.
II. EFFECT OF THERMAL HISTORY AND METALLIC ADDITIVES.
E.F.Westrum, Jr, and D.M.Grimes.
J. Phys. Chem. Solids, Vol. 6, No. 2-3, 280-6 (Aug., 1958).

The heat capacities of annealed and quenched samples of $Li_{0.05}Zn_{0.90}Fe_{2.05}O_4$ and of quenched $ZnFe_2O_4$ have been determined over the range 5°-350°K. Addition of lithium to zinc ferrite lowers the temperature of the co-operative thermal anomaly associated with antiferromagnetic ordering transition in accord with theory, and quenching of either material results in nearly complete disappearance of the λ-anomaly but modifies the pronounced high-temperature tail less significantly. The effects on the thermal properties are interpreted in terms of sublattice populations.

536.631 : 536.48

9569. HEAT CAPACITY OF ALUMINUM BETWEEN 0.1°K AND 4.0°K. N.E.Phillips.
Phys. Rev., Vol. 114, No. 3, 676-85 (May 1, 1959).

Measurements of the heat capacity of aluminium have been made etween 0.11 and 4.0°K in the normal state and between 0.17 and .0°K in the superconducting state. Within the experimental error ne normal state heat capacity, C_n, can be represented by $_n = \gamma T + \beta T^3$ with $\gamma = 1.35 \times 10^{-3}$ Joules/mole deg² and a value f β corresponding to a Debye temperature of 427.7° in agreement ith calculations based on elastic constants. For reduced tempera- ures between 0.5 and 0.25 the electronic heat capacity in the super- onducting state, C_{es}, is approximated by $C_{es}/\gamma T_c = 7.1 \exp(-1.34 \times$ $_c/T)$, in which T_c is the transition temperature, 1.163°K. At educed temperatures less than about 0.25, C_{es} is greater than an xtrapolation of the exponential, the difference amounting to a actor of 4 at the lowest temperature. The departure of C_{es} from n exponential temperature dependence, which is believed to be utside the experimental error, is not consistent with the existence f a constant energy gap at low reduced temperatures. The calcu- ated critical field is 103.0 G at 0°K and shows a maximum negative eviation of 4% from the parabolic law. The results are compared ith other measurements and with theory.

536.631 : 539.2

HEAT CAPACITY OF SPINELS, RELATIVE TO LATTICE ECIPROCITY. See Abstr. 8794

536.631 : 539.2

HEAT-CAPACITY FUNCTION WITH VELOCITY DISPERSION OR ISOTROPIC SOLIDS. See Abstr. 8818

536.631

570. SPECIFIC HEATS OF AMMONIUM, POTASSIUM, AND ODIUM CHLOROIRIDATES. C.A.Bailey and P.L.Smith.
hys. Rev., Vol. 114, No. 4, 1010 (May 15, 1959).

The specific heats were measured between 1.5° and 20°K; nomalies of the λ-type were found at 2.15, 3.05 and 3.95°K for the mmonium, potassium, and sodium salts, respectively. The results onfirm some conclusions drawn from magnetic susceptibility alues. The difficulties involved in the correct analysis of this type f specific heat measurement are discussed.

536.631 : 538.2

THERMAL PROPERTIES OF PRASEODYMIUM ETHYLSUL- HATE BELOW 1°K. See Abstr. 8281

536.633

571. VARIATION WITH PRESSURE OF THE SPECIFIC HEATS $_V$ AND C_p UP TO 900 ATM AND TO TEMPERATURES 300, 400, 00, 600, 700 AND 800°C. J.Saurel and A.Lecocq.
.R. Acad. Sci. (Paris), Vol. 248, No. 5, 653-5 (Feb. 2, 1959).
n French.

Values of C_V and C_p for nitrogen calculated from the experi- nental results described in Abstr. 3220 (1959) are shown graphic- lly. S.Weintroub

536.66

572. THERMODYNAMIC PROPERTIES OF NITRYL CHLORIDE.
.D.Ray and R.A.Ogg,Jr.
. chem. Phys., Vol. 31, No. 1, 168-71 (July, 1959).

The calorimetric heat of formation of gaseous nitryl chloride rom the elements at 25°C was found from the heat of the reaction f gaseous nitryl chloride with nitric oxide as confirmed by the eat of the reaction between nitrosyl chloride and nitrogen pentoxide. he value is +3.12 ± 0.16 kcal/mole (endothermic). From the quilibrium constants for the reactions $2NO_2 + Cl_2 = 2ClNO_2$ and $O_2 + ClNO = NO + ClNO_2$ the entropy of nitryl chloride at 25°C as found to be 65.46 ± 0.6 e.u.

536.66 : 539.2

HEAT OF FORMATION OF LITHIUM MONOSULPHIDE. ee Abstr. 8797

THERMODYNAMICS

536.7

573. ON THE MECHANICS AND THERMODYNAMICS OF ONTINUOUS MEDIA. O.J.Maggiolo.
ol. Fac. Ingen. Montevideo, Vol. 6, No. 8, 213-58 (Dec., 1957).
n Spanish.

An exposition, for students of engineering, of the fundamental rinciples of thermal and hydraulic machines, as a particular case f the thermodynamics of irreversible processes of systems with ariable mass. L.Pincherle

536.7

9574. ON THE THERMODYNAMICS OF IRREVERSIBLE PROCESSES. K.Popoff.
C.R. Acad. Bulg. Sci., Vol. 10, No. 2, 97-100 (March-April, 1957).
In French.

A note on the author's work: "Les bases mathematiques des processus irreversibles" [Memorial des Sciences physiques, Fasc. 63, Paris: Gauthier-Villars (1956)] justifying the passage from the phenomenological relations of Onsager to a Newtonian system of equations, the former appearing as the first integrals of the latter. T.P.Brody

536.7 : 539.219

9575. THERMODYNAMICS OF ORDERING ALLOYS. III. ENERGIES OF TRANSFORMATION OF THE $Au_{1/2}Cu_{1/2}$ PHASES.
R.A.Oriani and W.K.Murphy.
J. Phys. Chem. Solids, Vol. 6, No. 2-3, 277-9 (Aug., 1958).

Energy differences among the two superlattice and the disordered solid solution at the composition $Au_{1/2}Cu_{1/2}$ have been derived from calorimetric measurements of the heats of formation of the three phases. It is shown that neither of these transitions is understood in terms of quasi-chemical theory.

536.7 : 537.312.62

THERMODYNAMICS OF SUPERCONDUCTORS. See Abstr. 8164-5

536.7 : 548.5

CRYSTAL GROWTH AND THE THERMODYNAMICS OF IRREVERSIBLE PROCESSES. See Abstr. 8987

536.71

9576. INVESTIGATION OF THERMODYNAMIC SYSTEMS WITH NON-VANISHING NULLITY OF THE CONCENTRATION MATRIX.
L.S.Palatnik and V.S.Zorin.
Zh. tekh. Fiz., Vol. 28, No. 11, 2635-42 (1958). In Russian.

The phase rule determines the number of those variations of the independent thermodynamic variables which are compatible with the presence of a given number of phases. When all admissible variations are performed some phases may possibly remain invariant. In the present paper this phenomenon is investigated from the point of view of the thermodynamic theory of phase equilibria. It is, in particular, shown that sub-sets of phases may have less degrees of freedom than the whole system. The rank of the concentration matrix (every element of which is equal to the concentration of a component in a phase) plays an important part in the relevant deductions. R.Eisenschitz

536.72 : 539.382

ADIABATIC DEFORMATIONS OF RUBBER. See Abstr. 8934

ELECTRICITY
ELECTROSTATICS . DIELECTRICS

537.221

9577. METHODS OF MEASURING CONTACT POTENTIAL DIFFERENCE BY A [QUADRANT] ELECTROMETER.
G.Nadjakov and E.G.Nadjakova.
C.R. Acad. Bulg. Sci., Vol. 10, No. 6, 457-60 (Nov.-Dec., 1957).
In French.

A development and simplification of the methods described in previous papers (Abstr. 1856 of 1948, and C.R. Acad. Bulg. Sci., Vol. 2, No. 1, 33, 1949). P.M.Davidson

537.222

9578. ELONGATED LICHTENBERG FIGURES.
Y.Kamada and K.Umeda.
J. Phys. Soc. Japan, Vol. 12, No. 11, 1317 (Nov., 1957).

In studying Lichtenberg figures in non-stationary conditions the photographic plate was rotated, the needle electrode scratching a circular track on the plate. The negative figure was found to be elongated along the track while the positive one was unaffected. This appears to be due to the metal streak rubbed on the plate by the needle and thus gives support to the theory that the formation of Lichtenberg figures is due to electron flow. R.C.Glass

537.226.08 : 621.317.333

9579. MEASUREMENT OF DIELECTRIC PROPERTIES OF ELECTRICAL INSULATING MATERIALS. B.I.Vorozhtsov.
Pribory i Tekh. Eksper., 1959, No. 1, 112-15 (Jan.-Feb.).
In Russian.

Describes an unbalanced differential bridge circuit for the measurement of the permittivity and the loss-angle tangent of insulating materials. Two of the bridge arms are formed by two halves of the secondary winding of the input transformer. The third arm has a standard (air) capacitor in it and the fourth contains the sample. The circuit can be used for measurements of capacitance from 7 to 250 pF and of tan δ from 10^{-4} to 1 (and higher values), at frequencies from 20 c/s to 200 kc/s. A.Tybulewicz

537.226.1

9580. THE GRAPHICAL DETERMINATION OF THE PARAMETERS OF DEBYE-TYPE DISPERSION-ABSORPTION RELAXATION. C.Brot.
C.R. Acad. Sci. (Paris), Vol. 248, No. 3, 397-9 (Jan. 19, 1959).
In French.

Proposes forms for graphs to determine $(\epsilon_0 - \epsilon_\infty)$ and τ from experimental values either of ϵ' or of ϵ'' over a range of frequencies. The method of Cole (Abstr. 4630/1955) requires both ϵ' and ϵ''.
J.Hawgood

537.226.1

9581. DIELECTRIC CONSTANTS OF MIXTURES.
B.P.Pradhan and R.C.Gupta.
J. sci. industr. Res., Vol. 18B, No. 5, 185-8 (May, 1959).

Three different formulae have been derived for determining dielectric constants of mixtures of two components, having different shaped particles of one component embedded in a continuous medium of the other component. The validity of these formulae has been tested experimentally at 3090 Mc/s.

537.226.2 : 539.219

9582. A METHOD FOR THE STUDY OF PROCESSES IN IONIC CRYSTALS. M.J.Nurmia.
Ann. Acad. Sci. Fennicae A VI, No. 22, 10 pp. (1959).

The dielectric constant of an ionic crystal undergoes marked changes during polymorphic transitions and also during the formation and decomposition of solid solutions. An apparatus suitable for continuous recording of these changes is described and the method is applied to the transition in KNO_3 at 128° C, to the decomposition of NaCl—KCl mixed crystals, and to the formation of KCl—KBr mixed crystals from its components. The activation energies for the last two processes are found to be 1.09 and 0.92 eV.

537.226.2

9583. ANOMALOUS DISPERSION OF THE DIELECTRIC CONSTANT IN FELSPAR. V.A.Ioffe and G.I.Khvostenko.
Dokl. Akad. Nauk SSSR, Vol. 118, No. 4, 709-12 (Feb. 1, 1958).
In Russian. English translation in: Soviet Physics—"Doklady" (New York), Vol. 3, No. 1, 170-2 (Jan.-Feb., 1958).

The permittivity and loss angle of two different types of felspar were measured over the frequency range 500 c/s to 5 Mc/s and at temperatures from 20 to 500°K. An anomalous dispersion region in the nature of a resonance absorption was observed in both felspars, the loss angle peak occurring at 0.45 Mc/s independent of temperature, and the permittivity passing through a minimum. It is suggested that the absorption is due to weakly held positive holes at sites where aluminium ions are built into the crystal lattice in place of silicon ions. K.W.Plessner

537.226.2

9584. ON THE DIELECTRIC PROPERTIES OF α-PHASE N-HIGHER ALCOHOLS AND ASSOCIATED ELECTROMOTIVE FORCE. M.Takeyama.
J. Phys. Soc. Japan, Vol. 12, No. 10, 1167-8 (Oct., 1957).

Investigation of ϵ' and ϵ'' from several hundred cycles to 25 kMc/s shows that, in α-phase, dielectric dispersion occurs in the microwave region as well as at low frequencies. The frequency dependence of ϵ' and ϵ'' is illustrated for octadecyl alcohol. The temperature dependence of the e.m.f. obtained when samples are placed between two plates of different metals is shown and is very similar to the temperature dependence of ϵ' and ϵ''. R.C.Glass

537.226.2

9585. PRESSURE VARIATION OF ELECTRIC SUSCEPTIBILITY AT MICROWAVE FREQUENCIES. G.P.Srivastava.
J. sci. industr. Res., Vol. 18B, No. 5, 191-4 (May, 1959).

The electric susceptibility of methyl chloride and ethyl chloride, and its pressure variation have been studied in the X-band region. The values of different parameters have been substituted in a slightly simplified expression for electric susceptibility as given by Van Vleck and Weisskopf (1945) and the values of the electric susceptibility have been calculated at different pressures. The values calculated with the help of Van Vleck and Weisskopf's expression do not differ much from the experimentally observed values.

537.226.2 : 535.371

9586. ON THE NATURE OF THE PHOTODIELECTRIC EFFECT IN PHOSPHORS ZnS: Cu AND ZnS: Cu,Fe. O.V.Agashkin.
Optika i Spektrosk., Vol. 3, No. 1, 87-90 (July, 1957). In Russian.

Permittivity of ZnS: Cu and ZnS: Cu,Fe was measured at room temperature in darkness and on illumination. Both phosphors were in the form of powder suspensions in polystyrene or Perspex. The results were obtained at a frequency sufficiently high (10^5 – 5 × 10^6 c/s) to eliminate the effect of polarization due to space charge at powder-grain boundaries. It is found that permittiv ity increases considerably on illumination: this is known as the photodielectric effect. For ZnS: Cu permittivity increases from about 8 to 20-30 and in ZnS: Cu,Fe it increases from 8 to 15. In ZnS: Cu the main contribution to the photodielectric effect comes from photoconductivity, while in Zns: Cu,Fe filling of localization levels plays also its part. A.Tybulewic

537.226.2 : 537.228.

9587. DIELECTRIC POLARIZATION AND PIEZOELECTRIC PROPERTIES OF FERROELECTRIC SOLID SOLUTIONS OF CALCIUM, STRONTIUM AND BARIUM METANIOBATES IN LEAD METANIOBATES. V.A.Isupov and V.I.Kosyakov.
Zh. tekh. Fiz., Vol. 28, No. 10, 2175-85 (1958). In Russian.

Investigations were made of the dielectric polarization and dependence of Curie temperature on the concentration of calcium metaniobate in solid solutions in lead metaniobate. Certain solid solutions studied had high values of spontaneous polarization compared with that of barium titanate. The piezoelectric characteristi of solid solutions of barium and strontium metaniobates in lead metaniobate also had high values. Some piezoelectric characteristics are stable over a wide range of temperatures.
Z.Krasuc

537.226.

9588. CORRELATION OF DIELECTRIC LOSSES WITH STRUCTURE OF IONIC CRYSTALS AND THEIR MIXTURES.
N.P.Bogoroditskii, B.A.Kulik and I.D.Fridberg.
Zh. tekh. Fiz., Vol. 28, No. 10, 2165-72 (1958). In Russian.

In ion-relaxation polarization, dielectric losses are due to cry tal lattice defects which are not included in the expression for lattice energy. This explains the lack of correspondence between tan δ and lattice energy in a large number of alkali halide crystals. Structural changes in solid solutions of ionic crystals lead to instability in their dielectric properties. Z.Krasuc

537.226.31 : 621.315.613.

9589. HIGH-FREQUENCY DIELECTRIC LOSSES IN MUSCOVIT MICA WITH MINERAL INCLUSIONS OF LIMONITE AND BIOTITE. K.A.Vodop'yanov and I.G.Vorozhtsova.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 3, 283-7 (1958).
In Russian. English summary : PB 141041T-3, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington D.C., U.S.A.

Measurements were made of dielectric constant and loss tang in order to determine the effect of water of crystallization and of Fe_2O_3 at 1 Mc/s. Graphs of the dependence of these quantities on temperature are given which show a loss maximum in the 240 to 280° C temperature range. The values of dielectric constant and los depend on the initial heat treatment of the sample. R.C.Gla

537.226.

9590. HIGH-FREQUENCY DIELECTRIC LOSSES AND LATTIC ENERGY OF COMPOUNDS OF METALS FROM THE SECOND GROUP. A.A.Vorob'ev and A.P.Nakhodnova.
Zh. tekh. Fiz., Vol. 28, No. 10, 2173-4 (1958). In Russian.

In the range of frequencies from 450 to 900 kc/s dielectric losses of oxides and halide compounds of the elements of the seco group decrease with increasing frequency and increase with size c the cation. At a given temperature and frequency, tan δ is higher the lower the lattice energy of the compound. Z.Krasuc

537.226.32

91. ELECTRETS. A.Robillard.
Rech. Cent. Nat. Rech. sci., No. 46, 35-42 (March, 1959).
French.

A review article.

537.228.1

92. STUDY OF PIEZOELECTRIC TEXTURES [Étude des
xtures Piézoélectriques].
.V.Shubnikov, I.S.Zheludev, V.P.Konstantinova and I.M.Silvestrova.
aris : Dunod (1958), 207 pp. In French, translated from Russian.

Chapter 1 (Shubnikov): The problems of the theory of piezo- ectric textures; Chapter 2 (Konstantinova and Silvestrova): lectrical properties of Rochelle salt textures; Chapter 3 (Zheludev): iezoelectric textures containing a mixture of polycrystalline barium anate with another piezoelectric material. R.F.S.Hearmon

ELECTRIC CONDUCTION
SEMICONDUCTORS

537.311.31

93. THE ELECTRICAL CONDUCTIVITY OF LIQUID
AGNESIUM-BISMUTH ALLOYS. B.R.Ilschner and C.Wagner.
cta Metallurgica, Vol. 6, No. 11, 712-13 (Nov., 1958).

The conductivity was measured as a function of composition in e vicinity of that of the solid compound Mg_3Bi_2, and it was found drop by a factor of at least 3 within a composition range of 3 omic percent, with a minimum at the composition Mg_3Bi_2. The sults are explained by assuming that molten Mg_3Bi_2 is essentially nic, with equal relatively low concentrations of excess electrons d holes. C.Hilsum

537.311.31 : 539.234

94. INFLUENCE OF A SELENIUM LAYER ON THE ELECTRI-
AL CONDUCTIVITY OF VERY THIN GOLD LAYERS.
Minn and H.Damany.
Phys. Radium, Vol. 19, No. 6, 612 (June, 1958). In French.

The conductivity of an evaporated gold film is known to be ependent on the nature of the substrate. A film 20A thick on a ass substrate had a resistance of 10^{12} ohms per square. If a elenium layer 100A thick was deposited on the glass before the old, the gold film had a resistance of 10^{9} ohms per square. Elec- on diffraction showed that the selenium did not form an alloy with e gold. C.Hilsum

537.311.31 : 539.2

ELECTRICAL RESISTANCE OF VACANCY PAIRS (DIVACAN-
IES) IN MONOVALENT METALS. See Abstr. 8806

537.311.31 : 536.631 : 548.736

STUDY ON THE ORDERED ALLOY Ag_3Mg. See Abstr. 9026

537.311.32 : 621.316.86 : 621.317.34

95. CURRENT NOISE AND NONLINEARITY IN PYROLYTIC
ARBON FILMS. T.R.Williams and J.B.Thomas.
ev. sci. Instrum., Vol. 30, No. 7, 586-90 (July, 1959).

Measurements of current noise and nonlinearity in the pyrolytic rbon films of 322 resistors are given. The resistances and the mensions of the films both varied over a wide range. It is demon- rated that when the dimensions of the films are taken into account eir noise and nonlinearity are highly correlated: the noise in a ven film can therefore be used to estimate the nonlinearity, and nversely. In many groups of resistors of the same type the resis- nce change with a given applied voltage varied among resistors by factor of more than 10, and the noise power for a given current rough the resistors varied by a factor of more than 100. In the easurements of nonlinearity the resitance changes were often very nall, and consequently, were easily masked by temperature effects. measurement method was employed in which the resistors were aced in a balanced bridge, a short high-voltage pulse was applied the bridge, and the resistance change was determined from the idge output voltage. With this technique it was possible to measure sistance changes of the order of 20 p.p.m. with an accuracy of p.p.m.

537.311.32

9596. CONDUCTIVITY AND LATTICE ENERGY OF COMPOUNDS OF METALS FROM THE SECOND GROUP OF MENDELEEFF'S TABLE. A.A.Vorob'ev and A.P.Nakhodnova.
Zh. tekh. Fiz., Vol. 28, No. 10, 2192-3 (1958). In Russian.

It is shown that in the region of high temperatures specific conductivity and activation energy are determined by the binding energy of ions in the lattice and can be used to describe the electro-physical properties of the substance. Z.Krasucki

537.311.32 : 535.345

ELECTRICAL CONDUCTIVITY OF CdO FILMS. See Abstr. 9447

537.311.32 : 538.2

ELECTRICAL ANISOTROPIES OF IRON SULPHIDE SINGLE CRYSTALS. See Abstr. 8294

537.311.33 : 535.37 : 621.315.59 : 621.382

9597. SEMICONDUCTORS AND PHOSPHORS. [Halbleiter und Phosphore].
Brunswick : Vieweg (1958), 684 pp.

Proceedings of the International Colloquium held at Garmisch-Partenkirchen in 1956. (For a report of the colloquium, see Abstr. 2193 of 1957). About 100 papers are printed, some of them in summary form. (Abstracts of most of the papers — but not the summaries — will be found under the appropriate headings in this and succeeding issues of "Science Abstracts").

537.311.33

9598. THE CONDUCTIVITY OF SEMICONDUCTORS IN AN ULTRASONIC FIELD. V.A.Zhuravlev and M.I.Kozak.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 343-4 (Jan., 1959).
In Russian.

The effects of ultrasonic power densities (at 600 kc/s) of up to 10 W/cm^2 on the electrical conductivity of specimens of Se, Ge, CdS, Cu_2O and SnO_2 could be accounted for in terms of temperature changes. No specific action of the ultrasonic field per se being detected. The same was true with regard to changes in photoconductivity for specimens of CdS or Se. C.H.L.Goodman

537.311.33 : 537.32

9599. THE ROLE OF LOW-FREQUENCY PHONONS IN THERMOELECTRICITY AND THERMAL CONDUCTION. C.Herring.
Semiconductors and phosphors. See Abstr. 9597. pp. 184-235.

A comprehensive review containing much original material. The discussion is restricted to semiconductors. Topics considered include the discrepancy between the older theory and observations; the relation of Q_p (the phonon contribution to the thermoelectric power) to relaxation times of phonon modes; factors determining the relaxation times of phonons; Q_p for a large dilute semiconductor; the limitation of Q_p by boundary and imperfection scattering; the size effect in thermal conduction; saturation and other effects at high carrier densities; thermomagnetic and related effects; other effects; and the present state of our knowledge. An appendix deals with the vacuum semiconductor model. J.B.Birks

537.311.33 : 621.315.59

9600. SKIN EFFECT IN SEMICONDUCTORS.
A.H.Frei and M.J.O.Strutt.
Scientia Electrica, Vol. 5, No. 2, 51-60 (June, 1959). In German.

Deals with the theory of skin effect in semiconductor materials, including the effect of displacement currents, which are generally neglected in the skin effect theory for metallic conductors. In the case of flat plates, formulae are derived for field distribution, impedance and eddy-current power losses considering symmetrical electric as well as magnetic fields. Impedance as a function of frequency was measured for Ge at microwave frequencies. Measured values agree with theoretical results. The equivalent depth of penetration is calculated and compared with the skin depth for metals. All theoretical results are represented in graphs for different values of the ratio γ, i.e. displacement current divided by conduction current.

537.311.33

9601. THE INFLUENCE OF EXCHANGE ON THE EFFECTIVE MASS FORMALISM. E.O.Kane.
J. Phys. Chem. Solids, Vol. 6, No. 2-3, 236-41 (Aug., 1958).

The effective mass formalism of Adams (Abstr. 1072 of 1954) is generalized by the inclusion of exchange. The only difference is that the interband matrix elements in the effective mass sums contain a term from the exchange operator in addition to the usual term from the momentum operator. The exchange term is estimated theoretically and found to be significant. The interband matrix elements which cause optical absorption arise only from the momentum operator and not from the exchange operator. Hence a comparison of matrix elements determined from absolute optical absorption with elements estimated from effective mass sums provides an experimental method of finding the exchange effect, in principle. For the cases investigated so far, the exchange effect appears to lie within the uncertainties of the comparison.

537.311.33

9602. EXCHANGE TERMS IN THE EFFECTIVE MASS FORMALISM. J.C.Phillips.
J. Phys. Chem. Solids, Vol. 7, No. 1, 52-4 (Oct., 1958).

The magnitude of the exchange terms discussed in the preceding abstract is evaluated for silicon and germanium. The non-local corrections lead to the expression

$$[r^{\mu}, H] = (1 + \epsilon)(i\hbar p^{\mu})/m;$$

the quantity ϵ measures the non-local correction. For silicon $\epsilon = 0.29 \pm 0.10$ and for germanium $\epsilon = 0.26 \pm 0.10$.

537.311.33 : 539.2

ENERGY ABSORPTION BY CHARGE CARRIERS OF NEGATIVE EFFECTIVE MASS IN CRYSTALS. See Abstr. 8833

537.311.33

9603. TRANSPORT PROPERTIES OF NONDEGENERATE N-TYPE SEMICONDUCTORS CONSIDERING ELECTRON–ELECTRON SCATTERING. M.S.Sodha and Y.P.Varshni.
Phys. Rev., Vol. 114, No. 3, 717-18 (May 1, 1959).

Sodha and Eastman (Abstr. 5877 of 1958) have shown that the time of relaxation of an electron due to scattering by ions and electrons is given by $\tau = B\varphi(x)/x$, where x is proportional to its velocity and $\varphi(x)$ a function tabulated by Spitzer and Härm. In this paper the authors propose two analytical functions for $\varphi(x)$ which make the integrals appearing in transport theory readily integrable.

537.311.33

9604. TRANSPORT PHENOMENA IN NONDEGENERATE SEMICONDUCTORS CONSIDERING ELECTRON–ELECTRON SCATTERING. M.S.Sodha and Y.P.Varshni.
Z. Phys., Vol. 153, No. 5, 555-62 (1959).

Hall mobility and other transport properties of the electrons in n-type semiconductors are investigated when a magnetic field is applied, taking into account electron–electron scattering. Results are presented for different impurity densities.

537.311.33

9605. ON THE CONNECTION BETWEEN THE VARIOUS THEORIES OF THE SCATTERING OF CURRENT CARRIERS IN SEMICONDUCTORS. G.E.Pikus.
Zh. tekh. Fiz., Vol. 28, No. 11, 2390-401 (1958). In Russian.

It is shown that the constant E_1 occurring in the Bardeen–Shockley theory of the deformation potential is identical with the corresponding constants in the Bethe–Sommerfeld and Wilson theories of lattice scattering, and that when the zone extremum is at the centre of the Brillouin zone the Bethe–Sommerfeld method leads to the same results as the method of the deformation potential. An error in the calculation of E_1, made by Wilson and repeated by others, is pointed out and corrected. K.F.Hulme

537.311.33 : 621.315.59

9606. MEASUREMENT OF MINORITY CARRIER DIFFUSION LENGTH AND LIFETIME BY MEANS OF THE PHOTOVOLTAIC EFFECT. M.Waldner.
Proc. Inst. Radio Engrs, Vol. 47, No. 5(I), 1004-5 (May, 1959).

If light is filtered by sufficient thickness of a given semiconductor it may then be used to obtain uniform carrier generation near a p—n junction in a specimen of the same semiconductor. Together with an independent measurement of the minority carrier diffusion distance this gives the charge generation rate of the filtered radiation. Silicon with diffused gallium or boron was investigated. The short circuit photovoltaic current is large enough to measure in samples with $\tau \cong 0.1$ μsec. G.F.J.Garlick

537.311.33 : 539.2

9607. THE ZENER EFFECT AND IMPACT IONIZATION. W.Franz.
Semiconductors and phosphors. See Abstr. 9597. pp. 317-28. In German.

Approximations in the derivation of Zener's internal field emission equation prevent it being applied quantitatively. In the first part of this theoretical paper a quantitative relation is derived for the three-dimensional crystal by evaluating Houston's theory by complex methods, allowing for Coulomb interaction between the conduction electron and valence hole created. The second part of the paper gives the theory of impact ionization of the valence band by a conduction electron. The conduction electron is assumed quasi-free, with its energy varying parabolically with wave number. The energy required for impact ionization is rather larger that the optical band gap. Above this energy the ionization rate increases as the second or third power (depending on the band structure) of the excess energy. J.B.Birks

537.311.33

9608. IMPURITY SCATTERING IN SUPERCONDUCTORS. H.Suhl and B.T.Matthias.
Phys. Rev., Vol. 114, No. 4, 977-88 (May 15, 1959).

With the Bardeen—Cooper—Schrieffer (B.C.S.) theory as a starting point, perturbation theory is used to determine the reduction in superconducting transition temperature due to scattering by impurities dissolved in the superconductor. Two cases are discussed: scattering due to a localized exchange interaction between the spins of the conduction electrons and impurity spins, and purely orbital scattering by nonmagnetic impurities. In the former case good quantitative agreement with observations is obtained. In the latter case numerical agreement is less good, but the qualitative feature, that the initial reduction in T_C is a universal function of residual resistivity is made evident. It is further shown that indiscriminate application of perturbation theory of B.C.S. states leads to the wrong result in predicting the transition temperature, if the transition is of second order.

537.311.33 : 577.3

9609. RELATION BETWEEN EXCITON BANDS AND CONDUCTION BANDS IN MOLECULAR LAMELLAR SYSTEMS. M.Kasha.
Rev. mod. Phys., Vol. 31, No. 1, 162-9 (Jan., 1959).

A critical examination of the differences between atomic and molecular array problems with the object of assessing the validity of applying the ideas of solid-state physics to biological mechanisms. A simple account is given of excitation-energy transfer and of electronic conduction in atomic and molecular aggregates. The following topics are discussed: excitons; origin of exciton bands and conduction bands; properties of exciton bands; molecular systems as photoconductors and semiconductors; photophysical steps in the primary process of photosynthesis. Forty-seven references. J.Ibal

537.311.33

9610. EFFECTS ASSOCIATED WITH A LINEAR ENERGY TERM IN THE VALENCE BAND OF INTERMETALLIC SEMICONDUCTORS F.Stern.
J. Phys. Chem. Solids, Vol. 8, 277-80 (Jan., 1959).

Rochester Semiconductors Conference Paper (see Abstr. 4569 of 1959). The linear term has already been established from measurements of the optical absorption in p-type material, associated with transitions between the light and heavy holes. At low temperatures the linear term causes a change in the expected value of electrical properties and some experimental evidence for the effect in InAs is presented. C.A.Hogart

537.311.33 : 539.21

INTERDIFFUSION IN BINARY IONIC SEMICONDUCTORS. See Abstr. 8887

537.311.33 : 541.135.

SEMICONDUCTOR–ELECTROLYTE ELECTRODE. EQUILIBRIUM POTENTIAL DISTRIBUTION. See Abstr. 8963

537.311.33 : 537.312.

9611. INFRARED ABSORPTION OF FREE CARRIERS PRODUCE IN SEMICONDUCTORS BY PHOTOEFFECT. F.R.Kessler.
J. Phys. Chem. Solids, Vol. 8, 275-7, 285 (Jan., 1959).

Rochester Semiconductors Conference Paper (see Abstr. 4569 of 1959). A study of the absorption of germanium and silicon as functions of wavelength and temperature and arising from photoelectrically generated free charge carriers is described. C.A.Hogart

537.311.33

9612. INFRARED LATTICE VIBRATION STUDIES OF POLAR CHARACTER IN COMPOUND SEMICONDUCTORS.
G.Picus, E.Burstein, B.W.Henvis and M.Hass.
J. Phys. Chem. Solids, Vol. 8, 282-4, 285 (Jan., 1959).

Rochester Semiconductors Conference Paper (see Abstr. 4569 of 1959). The polar bonding in III-V materials leads to an effective residual charge on the atoms, which can be determined from the reflectivity in the anomalous dispersion region, together with information about the optical and static dielectric constants. Measurements of reflectivity in the far infrared of AlSb, GaAs, GaSb, InP, and InAs are reported and the transverse and longitudinal lattice vibration frequencies together with the effective charge are estimated. C.A.Hogarth

537.311.33 : 539.4.016

9613. ELECTRICAL RESISTIVITY CHANGES FROM FORMATION OF ZONES IN ALUMINIUM ALLOYS. M.E.Fine.
Acta metallurgica, Vol. 7, No. 3, 228-9 (March, 1959).

It is suggested that in Al—Cu alloys the zones formed during cold hardening contain rows of Cu atoms in the (1,1,0) directions. Each row may be thought of as a pair of edge dislocations of opposite sign, one above and one below the zone. The increase in resistivity would be due to scattering by these rows of Cu atoms, as well as by the lattice strain. L.Pincherle

537.311.33

9614. ELECTRICAL RESISTIVITY OF ARC-EVAPORATED CARBON FILM. H.Toyoda and M.Nagashima.
J. Phys. Soc. Japan, Vol. 14, No. 3, 274-81 (March, 1959).

The resistance has a large negative temperature coefficient. Annealing decreases both the resistance and its temperature dependence. The specific resistivity depends on the film thickness, and increases rapidly below 500 A. It seems that the lattice imperfections (whose distribution is discussed) play the most important role. The ageing effects on the resistance were also measured.

537.311.33 : 535.343

9615. INTERVALENCE BAND TRANSITIONS IN GALLIUM ARSENIDE. R.Braunstein.
J. Phys. Chem. Solids, Vol. 8, 280-4, 285 (Jan., 1959).

Rochester Semiconductors Conference Paper (see Abstr. 4569 of 1959). The absorption spectra of GaAs are measured as functions of temperature and of carrier concentration and the results are interpreted in terms of intervalence band transitions. From the arguments presented similar effects would be expected with InP, GaP, AlP, AlAs, and AlSb. C.A.Hogarth

537.311.33 : 548.5

PROPERTIES OF GALLIUM ARSENIDE SINGLE CRYSTALS. See Abstr. 8993

537.311.33 : 539.217

ELECTRICAL BEHAVIOUR OF COPPER IN GALLIUM ARSENIDE. See Abstr. 8881

537.311.33

9616. METHODS FOR DETERMINATION OF DISTRIBUTION OF SURFACE STATES IN Ge AND Si. J.Bardeen.
Semiconductors and phosphors. See Abstr. 9597. pp. 81-97.

An outline of the methods employed and the results obtained in studies of the energy distribution and trapping cross-sections of surface states on Ge and Si. After an introduction in which the surface properties measured are considered and compared, surface conductance and the field effect, channel effect measurements and surface recombination are discussed. There are 34 references. J.B.Birks

537.311.33

9617. EFFECT ON THE CONDUCTIVITY OF GERMANIUM OF BOMBARDMENT WITH HIGH ENERGY ELECTRONS.
N'Guyen Van Dong, L.Koch, P.Baruch and P.André.
C.R. Acad. Sci. (Paris), Vol. 248, No. 6, 788-91 (Feb. 9, 1959).
In French.

Simple theory indicates that if a p—n junction is exposed to high-energy radiation, the short circuit current will decrease with time, being inversely proportional to the square root of the integrated flux. Experiments at room temperature confirm this, but if the junction is kept at 100°K during the bombardment, the current passes through a minimum and then increases rapidly. This is explained in terms of a shift in the Fermi level. C.Hilsum

537.311.33

9618. ELECTROMAGNETOPHOTONIC EFFECT IN Ge.
M.Bernard.
J. Phys. Chem. Solids, Vol. 8, 332-6, 336-7 (Jan., 1957). In French.

Rochester Semiconductors Conference Paper (see Abstr. 4569/1959). In an intrinsic sample, the thickness of which is substantially less than the ambipolar diffusion length, it is shown that simultaneous electric and magnetic fields must induce infrared emission through recombination transitions; this electromagnetophotonic effect (EMP), which is the reciprocal of the photomagnetoelectric effect (PME), has been observed. Volume recombination (direct radiative process) near the face of the sample where carriers are accumulated by the Laplace force seems responsible for the observed emission. The efficiency of radiative processes in surface recombinations, for wavelengths less than $3.3\,\mu$, is not appreciable but is in any case $< 10^{-6}$.

537.311.33

9619. HOT-ELECTRON BEHAVIOR IN GERMANIUM UNDER THE INFLUENCE OF A MAGNETIC FIELD. L.Gold.
Phys. Rev., Vol. 114, No. 3, 691-704 (May 1, 1959).

The theory of the hot-electron problem in many-valley semiconductors based upon the individual ellipsoidal energy surface model is extended for germanium to the circumstance of a superposed magnetic field B. A first approach, ignoring collisional effects, allows ready delineation of the electron orbits; directional energy gain is evaluated for E_{100} and E_{110} with B rotated in longitudinal and transverse orientations. The anisotropy is found to be quite marked (decidedly stronger than for $B = 0$), with the longitudinal arrangement more effective than the transverse one. The introduction of scattering considerably complicates the analysis and here consideration is given to the effective ratio b of Larmor to scattering frequency. In the limit $b \to \infty$ and the scattering decidedly anisotropic, transverse energy gain vanishes; whereas in the longitudinal alignment, the energy gain becomes extremely anisotropic. The shift in the optimal energy gain direction(s) is noted for selected combinations of E and B and comparisons made with the case $B = 0$. As $b \to 0$, the anisotropy diminishes; detailed calculations have been performed for $b = 1$, 0.1, and ∞ for the limiting cases of isotropic and strongly anisotropic scattering.

537.311.33

9620. CONDUCTIVITY OF GROWN GERMANIUM-BICRYSTALS.
H.F.Mataré, B.Reed and O.A.Weinreich.
Z. Naturforsch., Vol. 14a, No. 3, 281-4 (March, 1959).

Measurements of the grain boundary conduction in Ge bicrystals grown from material of widely different impurity ranges show sheet resistivities of 0.003 to 0.01 ohm cm for an assumed grain boundary layer width of 100 A. This value is practically constant throughout a temperature range from 2° to 300°K if leakage currents through the bulk are kept small by the use of junction contacts. This and the linear I—V characteristic suggest that the conductivity mechanism is dominated by the free orbitals and their overlapping wavefunctions in the internal surface layer.

537.311.33

9621. A STUDY OF THE INDUCED ABSORPTION OF INFRARED RADIATION IN A GERMANIUM DIODE. Yu.I.Ukhanov.
Zh. tekh. Fiz., Vol. 28, No. 11, 2410-16 (1958). In Russian.

The change in the infrared absorption coefficient due to holes injected into n-type Ge was studied as a function of the distance from the injecting p—n junction, x, the injection level, and temperature (80°-300°K). The absorption varied with x less rapidly than the photovoltaic effect produced by the more rapid absorption of shorter wavelengths; this was interpreted as due to the shorter effective lifetime near the surface (surface recombination). Estimates of the absorption cross-section of the injected carriers varied from $(0.1 \text{ to } 12) \times 10^{-16}\ \text{cm}^2$, depending on whether diffusive or drift motion of the electrons in the diodes was assumed to be predominant; the diffusion estimate $0.1 \times 10^{-16}\ \text{cm}^2$, led to a hole effective mass of 0.04 times the free electron mass. The effect of temperature on the phenomenon is discussed in terms of mobility and lifetime changes. K.F.Hulme

537.311.33

9622. SOME PROPERTIES OF MERCURY TELLURIDE.
H.Fumeron-Rodot and M.Rodot.
C.R. Acad. Sci. (Paris), Vol. 248, No. 7, 937-40 (Feb. 16, 1959).
In French.

Specimens of both n- and p-type HgTe were prepared. The room temperature Hall mobility of electrons was as high as

$22\,000\ \mathrm{cm}^2\ \mathrm{V}^{-1}_{\mathrm{sec}}{}^{-1}$. The mobility ratio was in agreement with the value of 70 given by Lawson, Nielsen, and Young. Studies of the magnetothermoelectric effect and of the Nernst effect from 77° to 300° K suggest that the mobility is limited by collisions of the electrons with the acoustic phonons. C.A.Hogarth

537.311.33

9623. GALVANOMAGNETIC EFFECTS IN N-TYPE INDIUM ANTIMONIDE AT VERY LOW TEMPERATURES.

Y.Kanai and W.Sasaki.

J. Phys. Soc. Japan, Vol. 12, No. 10, 1169 (Oct., 1957).

These effects were measured in single crystals, doped with Te, at temperatures of 1.4° and 4.2°K. Both the Hall coefficient and the magnetoresistance show the same anomaly of oscillation. A table of numerical values for crystals of various carrier concentrations and orientations is given together with curves of the oscillatory effect. W.Bardsley

537.311.33

9624. SOME EFFECTS OF COPPER AS AN IMPURITY IN INDIUM ARSENIDE.

C.Hilsum.

Proc. Phys. Soc., Vol. 73, Pt 4, 685-6 (April, 1959).

Several authors have reported that heat treatment of InAs above 300° C makes the material more n-type and that this change can be annealed out at temperatures below 200° C. Similar results have been obtained with specimens doped deliberately with copper and a comparison with undoped material shows that some of the observed heat treatment effects are due to a residual copper impurity which acts as a donor. W.Bardsley

537.311.33

9625. THERMOMAGNETIC EFFECTS IN INDIUM ANTIMONIDE.

V.P.Zhuze and I.M.Tsidil'kovskii.

Zh. tekh. Fiz., Vol. 28, No. 11, 2372-81 (1958). In Russian.

The transverse and longitudinal Nernst—Ettinghausen effects, the thermoelectric powers, electrical conductivities, and Hall constants, of four InSb samples were measured; one sample had 7×10^{16} electrons/cm³, the others had 1.5×10^{18}, 1.2×10^{18}, and 6×10^{16} holes/cm³ (at ~ 140°K); magnetic fields up to 10 000 Oe were used and temperatures of 120° to 657°K. The results (given graphically) could be explained satisfactorily on existing theories and illustrated the predominance of acoustical over optical-phonon scattering of carriers. K.F.Hulme

537.311.33 : 539.23

ELECTRICAL PROPERTIES OF THIN, VACUUM DEPOSITED FILMS OF INDIUM ANTIMONIDE. See Abstr. 8904

537.311.33

9626. ACTIVATION ENERGY FOR HOLE MOTION IN $\mathrm{Li_xNi_yCo_{1-x-y}O}$.

R.C.Miller, R.R.Heikes and W.D.Johnston.

J. chem. Phys., Vol. 31, No. 1, 116-18 (July, 1959).

The electrical resistivity of $\mathrm{Li_xNi_yCo_{1-x-y}O}$ shows an anomalous increase at y = 0.84, the composition at which the amount of Li is equal to the amount of Co. This increase, predominantly caused by a corresponding increase in activation energy, is interpreted as evidence that the electrical conduction mechanism may be represented as a thermally activated diffusion of positive holes having a mean free path or jump distance of one lattice distance.

537.311.33

9627. INFLUENCE OF FOREIGN IONS ON THE SEMICONDUCTIVITY OF DIOXIDES OF MANGANESE.

J.P.Chevillot and J.Brenet.

C.R. Acad. Sci. (Paris), Vol. 248, No. 6, 776-8 (Feb. 9, 1959). In French.

Measurements of the temperature variation of electrical conductivity suggest that β-MnO$_2$ is an intrinsic semiconductor of gap width 0.26 eV, whereas γ-MnO$_2$ is "partially" intrinsic, the activation energy being 0.7 eV. Substituted Th^{++++} decrease strongly the conductivity for both the types of MnO$_2$ but do not affect the intrinsic behaviour. C.A.Hogarth

537.311.33 : 535.343

9628. RECENT ADVANCES IN THE OPTICAL AND ELECTRONIC PROPERTIES OF PbS, PbSe, PbTe AND THEIR ALLOYS.

W.W.Scanlon.

J. Phys. Chem. Solids, Vol. 8, 423-8, 442-3 (Jan., 1959).

Rochester Semiconductors Conference Paper (see Abstr. 4569/1959). The optical and electrical properties of PbS, PbSe, and PbTe are reviewed as they contribute to the understanding of the electronic band structure in these compounds. The optical absorption data generally favours a model in which the maximum of the valence band and the minimum of the conduction band occur at abou the same value of the wave vector, k. Magnetoresistance data for these crystals are similar for n- and p-type crystals and the long tudinal magnetoresistance is generally larger (in some cases four or five times larger) than the transverse magnetoresistance at 77° and 4.2° K. The magnetoresistance data suggest that both band edge have the same structure and that constant energy surfaces are ellipsoids of revolution about the ⟨111⟩ direction with centres away fron k = 0. A ratio of longitudinal to transverse effective mass of from 4-6 is though to be most appropriate for PbTe.

537.311.33

9629. THE GALVANOMAGNETIC EFFECTS IN SINGLE CRYSTAL OF PbTe.

K.Shogenji and S.Uchiyama.

J. Phys. Soc. Japan, Vol. 12, No. 10, 1164 (Oct., 1957).

Reports measurements of the magnetoresistance effect and also the planar Hall effect in synthetic p-type crystals whose Hall coefficient was +2.48 cm³/coulomb and resistivity 1.93×10^{-4} ohm at 90° K with normal temperature dependence. Measurements were made at 90° K and with 8000 G on specimens cut with their long axis along [100] and [110]. It is concluded that this material has spheroidal energy surfaces with their extrema along ⟨111⟩ axes. W.Bardsle

537.311.3

9630. GOLD IN SILICON.

G.Bemski and J.D.Struthers.

J. Electrochem. Soc., Vol. 105, No. 10, 588-91 (Oct., 1958).

Heat treatment of silicon, both p-type and n-type, to temperatures in excess of 900° C frequently results in a decrease of lifetime and is sometimes accompanied by an increase in resistivity. In the present experiments, gold has been found to be introduced during such heat treatments in concentrations sufficient to account for the observed changes in the electrical characteristics. Gold has been observed on the surfaces of all the silicon samples examined so far. Heat treatments in the temperature range 1100°-1300° result in a concentration of gold in the bulk material of about 10^{14} atoms/cm³. A film of nickel or copper on the silicon surface durin the heat treatment has a gettering action for gold. Heat treatment in vacuum can also be effective in the removal of gold.

537.311.3

9631. LIFETIMES AND CAPTURE CROSS SECTIONS IN GOLD-DOPED SILICON.

W.D.Davis.

Phys. Rev., Vol. 114, No. 4, 1006-8 (May 15, 1959).

The free lifetimes of electrons and holes in gold-doped silicon were determined by applying an electric field and measuring the amplitude of the pulses produced by α-particles. Knowing the impurity concentrations and assuming that the lifetime is determin primarily by capture at the gold-sites, the cross-sections for captu were calculated. The value for either electrons or holes at neutral gold sites is 2×10^{-15} cm² and at oppositely-charged sites, 1×10^{-13} cm².

537.311.3

9632. MEASUREMENTS OF THE TEMPERATURE VARIATION OF THE EFFECTIVE MASS OF THE FREE CARRIERS IN SILICO WITH 3 cm WAVELENGTH.

T.Stubb.

State Inst. Tech. Res. Finland Publ., No. 42, 49 pp. (1958).

Measurements of dielectric constant of disc-shapes Si specimens were made using a cavity resonator. The range from 90° K t room temperature was covered and the equipment detected frequency shifts with an accuracy of ±1.5%. The results are reported for specimens containing impurity concentrations of order 10^{18} cm The effective mass m* of holes increases more strongly with increasing temperature than for electrons. The numerical results f −58.5° C are: Electrons, $(m^*/m_o) = 0.35$; Relaxation time $\tau_e = 2.2 \times 10^{-14}$ sec.; Holes, $(m^*/m_o) = 0.52$; $\tau_h = 5.4 \times 10^{-13}$ sec. C.A.Hogar

537.311.

9633. ON THE QUANTUM YIELD OF THE PHOTO-IONIZATIO IN SILICON.

V.S.Vavilov and K.I.Britsȳn.

Zh. eksper. teor. Fiz., Vol. 34, No. 5, 1354-5 (1958). In Russian. English summary: PB 141052T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Following previous work on germanium, measurements have been made on p—n junctions produced by diffusing phosphorus into silicon. The depth of the junction was less than 2μ. The product c the absorption coefficient and quantum yield and the reflection coefficient are displayed graphically as a function of photon energy. The results indicate that ionization by collision takes places for energies > 3.25 eV in agreement with the work of McKay (Abstr. 6995 of 1958). D.J.Oliv

537.311.33

34. ELECTRICAL PROPERTIES OF SnTe, SnSe AND InBi
: LOW TEMPERATURES. K.Hashimoto.
Phys. Soc. Japan, Vol. 12, No. 12, 1423 (Dec., 1957).

The electrical resistivity ρ and the Hall coefficient R of these
mpounds were measured in the temperature range between 2^0 and
0^0K. The results are shown in three graphs. For InBi only the
sistivity tensor component ρ_{11} is shown as R could not be
asured in this range. W.Bardsley

537.311.33

35. ELECTRICAL PROPERTIES OF STANNOUS SELENIDE.
Asanabe.
Phys. Soc. Japan, Vol. 14, No. 3, 281-96 (March, 1959).

The electrical resistivity, Hall coefficient and thermoelectric
wer were investigated over the temperature range from 100^0 to
0^0K on pure and impurity-doped SnSe crystals. An anomalous
mp of the Hall coefficient was found to occur at about 200^0C in
ost of the as-grown crystals: this would seem to invalidate the
nventional analysis based on a simple semiconductor model.
isotropies in the resistivity and Hall coefficient were also studied
single crystals and the observed anisotropy in the resistivity
ems to be ascribed to an anisotropy in the effective mass of the
les. Hole mobility varies as $T^{-2.0}$ at high temperatures and its
parture from the $T^{-1.5}$ law is explained on the assumption of both
tical and acoustical mode scatterings. An investigation was made
the anomalous Hall coefficient on heating the specimen at various
mperatures in vacuum. This phenomenon was found to depend on
heat-treatment history of the crystal and the experimental re-
lts were analysed on such a simple model that acceptors are
roduced into SnSe by impurity diffusion above 200^0C and caused
disappear on heating at lower temperatures. General features
served seem to be in fair agreement with the proposed model.

537.311.33 : 535.32

36. OPTICAL PROPERTIES OF TELLURIUM AND SELENIUM.
S.Caldwell and H.Y.Fan.
ys. Rev., Vol. 114, No. 3, 664-75 (May 1, 1959).

The optical properties of tellurium and of trigonal and amor-
ous selenium were investigated at wavelengths extending from
intrinsic absorption edge to about 152 microns using polarized
diation. The refractive indices of tellurium and trigonal selenium
ve been determined from 4 to 14 microns and from 9 to 23 microns,
spectively. For amorphous selenium, the refractive index esti-
ated from measured reflectivity shows no appreciable variation
om 30 to 152 microns. The temperature shift and the pressure
ift of the intrinsic absorption edge in amorphous selenium are
nd to be -1.45×10^{-3} eV/^{0}K and -2.0×10^{-5} eV/atm, respectively.
ttice absorption bands have been observed in tellurium and
lenium; they are attributed to the excitation of combination modes.
tellurium, a strong absorption band has been observed at 11
crons, which is present only for $E \| c$ radiation. The band indica-
s that there are overlapping branches in the valence band which
e separated by about 0.11 eV. The effective mass in the lower
anch is estimated to be about four times smaller than that in the
per branch. It is possible that the structure of the valence band
responsible for the high-temperature reversal of the Hall effect
telluirum. The usual carrier absorption increasing smoothly
th wavelength has been studied for tellurium using polarized radia-
ns. The effective mass of holes in tellurium has been determined
om reflectivity measurements: $m_\perp \sim m_{\|} = 0.45$ m at 300^0K,
$= 0.30$ m and $m_{\|} = 0.45$ m at 100^0K.

537.311.33 : 538.27

SPIN RESONANCE OF DONORS IN CdS. See Abstr. 8343

537.311.33

37. ON THE DELINEATION OF P—N JUNCTIONS IN SILICON.
A.Iles and P.J.Coppen.
appl. Phys., Vol. 29, No. 10, 1514 (Oct., 1958).

Gives three methods which involve deposition on the junction
copper or silver from copper sulphate or silver fluoride solution.
is suggested that two competing processes are involved, a dis-
acement action and an electrolytic deposition. C.Hilsum

537.311.33 : 621.315.59

38. OHMIC ALUMINUM-n-TYPE SILICON CONTACT.
L.Matlow and E.L.Ralph.
appl. Phys., Vol. 30, No. 4(1), 541-3 (April, 1959).

A method of making an ohmic alloyed contact to n-type silicon
ing aluminium has been developed. In the usual procedures for alloying aluminium to silicon a regrowth region of β-aluminium—silicon alloys is formed which is monocrystalline with the parent silicon. As a result of the junction formed between the n-type silicon and the p-type regrowth, the contact is rectifying. However, by the careful control of the heating and cooling cycles, it is possible to prevent the deposition of the β phase on to the surface of the parent silicon. Thus, an ohmic contact is obtained. The theory of the process is discussed. By this technique it has been possible to develop a "ruggedized" solar energy converter for use in space vehicles.

537.311.62

9639. CONTRIBUTION TO THE THEORY OF SURFACE IMPEDANCE OF METALS IN ANOMALOUS SKIN EFFECT. M.Ya.Azbel'.
Zh. eksper. teor. Fiz., Vol. 34, No. 3, 766-7 (March, 1958). In Russian. English translation in: Soviet Physics—JETP (New York), Vol. 34(7), No. 3, 527 (Sept., 1958).

It is shown that the theoretical results obtained by treating the electrons as a Fermi gas are unaffected if electron—electron interactions are taken into account by using Landau's model of a Fermi liquid. R.G.Chambers

537.312.5

9640. PHOTO-ELECTRO-MAGNETIC AND MAGNETIC BARRIER LAYER EFFECTS. T.S.Moss.
Semiconductors and phosphors. See Abstr. 9597. pp. 98-112.

A detailed treatment of the theory of the photo-electro-magnetic effect is given for the small-signal case with linear surface and bulk recombination. The effect of high magnetic fields and different recombination velocities on the front and back surfaces is considered. The effect of high illumination intensity for various linear and bimolecular recombination laws is indicated. The theory of the magnetic barrier layer effect, which has some features similar to the photo-electro-magnetic effect, is outlined. J.B.Birks

537.312.5 : 537.312.8

9641. ON THE ANISOTROPY OF THE EVEN PHOTOMAGNETIC EFFECT. Yu.A.Kagan and Ya.A.Smorodinskii.
Zh. eksper. teor. Fiz., Vol. 34, No. 5, 1346-7 (1958). In Russian. English summary: PB 141052T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Gives a phenomenological theory of the effect discovered by Kikoin and Bykovskii (Abstr. 2331 of 1958). D.J.Oliver

537.312.5

9642. PHOTOCONDUCTIVITY IN A RIGID GLASS.
A.C.Albrecht and M.E.Green.
J. chem. Phys., Vol. 31, No. 1, 261-2 (July, 1959).

Glass was made photoconductive by dissolving in it an organic substance, which was photo-oxidized under u.v. excitation. Measurements of the time constants of the photocurrent decay were made. J.Franks

537.312.5

9643. COMPARATIVE INVESTIGATIONS OF THE LONGITUDINAL AND TRANSVERSE PHOTOVOLTAIC EFFECTS IN EVAPORATED CADMIUM SULPHIDE. G.Nadjakov, R.Andrejtschin, S.Balabanov and J.Stanislavova.
C.R. Acad. Bulg. Sci., Vol. 10, No. 4, 277-80 (July-Aug., 1957). In German.

By using different electrode arrangements on CdS layers, illumination can produce electric fields at right angles to or parallel to its incident direction. Experiments show that the photovoltaic effect in the CdS layers is associated with the electrode crystal boundaries and is not a bulk effect. G.F.J.Garlick

537.312.5

9644. ON THE MECHANISM OF ENERGY TRANSPORT.
M.Balkanski.
J. Phys. Chem. Solids, Vol. 6, No. 4, 401-2 (Sept., 1958). In French.

The author criticizes the conclusions of the article with the same title by Broser and Broser-Warminsky [J. Phys. Chem. Solids, Vol. 6, 386 (1956)] in which they assume that scattering of light rather than exciton diffusion through cadmium sulphide crystals is responsible for transport of exciton energy over large distances. He assumes that total internal reflection is not significant; immersion of the crystal in high refractive index liquids does not affect the transport. G.F.J.Garlick

537.312.5

9645. REPLY TO THE REMARKS OF M.BALKANSKI ON THE WORK "ON THE MECHANISM OF ENERGY TRANSPORT IN CADMIUM SULPHIDE CRYSTALS".
I.Broser and R.Broser-Warminsky.
J. Phys. Chem. Solids, Vol. 9, No. 2, 181-2 (Feb., 1959). In German.

The authors reply to Balkanski's criticisms of their conclusions (see preceding abstract) that exciton diffusion in CdS has not been established. They produce further experimental evidence to support their theory of photon diffusion, in particular that from experiments before and after cleaving and recementing together a single crystal. Exciton diffusion constant measurements they affirm to be obscured by the slow decay of photoconductivity. G.F.J.Garlick

537.312.5

9646. THE SPECTRAL DISTRIBUTION OF PHOTOCONDUCTIVITY IN Cu_2O CRYSTALS AT 20°K. V.V.Eremenko.
Zh. tekh. Fiz., Vol. 28, No. 10, 2261-3 (1958). In Russian.

A study of photoconductivity in the region 15 000 - 19 000 cm^{-1}. Sharp peaks were observed at 17 480, 17 975 and 18 500 cm^{-1}. No obvious relationship was apparent between these and sharp lines of optical absorption previously ascribed to exciton effects (see Abstr. 5389 of 1953). C.H.L.Goodman

537.312.5

9647. ON A POSSIBLE EXPLANATION OF STRONG PHOTOVOLTAIC EFFECTS IN PbS LAYERS. T.Figielski.
Bull. Acad. Polon. Sci. Ser. Sci. math. astron. phys., Vol. 7, No. 3, 179-81 (1959).

The large photovoltages reported for layers of PbS and Tl_2S are attributed to photovoltaic effects at the microcrystalline boundaries, the latter being illuminated in an asymmetrical manner due to shading of the light by the crystals when illumination is from a specific direction. Processing of the layers during sensitization increases the intercrystalline boundary potentials, e.g. by adsorption of oxygen at such sites. G.F.J.Garlick

537.312.5

9648. MODIFICATION OF PbS NOISE SPECTRA BY RADIATION. R.L.Williams.
Canad. J. Phys., Vol. 37, No. 7, 841-7 (July, 1959).

The noise spectra of PbS photoconductive cells can be modified by optically excited carriers. Detailed wavelength studies at CO_2 temperatures have shown that g—r noise can be obtained using light of the 2.4-micron region, and the 1/f form with radiation of the 1.0-micron region. The effect is explained by assuming that minority carrier lifetimes in Kodak Ektron detectors are very short. The 1/f noise is only observed when optical carriers are produced very near the cell surface.

537.312.5

9649. THE PHOTOVOLTAIC EFFECT IN EVAPORATED LEAD SULPHIDE LAYERS. R.Andrejtschin and A.Zlateva.
C.R. Acad. Bulg. Sci., Vol. 10, No. 4, 281-4 (July-Aug., 1957). In German.

It is concluded that the photovoltaic effects observed arise from contact potentials between the electrodes applied to the PbS layer. G.F.J.Garlick

537.312.5

9650. INFLUENCE OF SELENIUM MICROSTRUCTURE ON PHOTOCELL CHARACTERISTICS. T.K.Lakshmanan.
J. appl. Phys., Vol. 30, No. 2, 265-6 (Feb., 1959).

Cells containing a large number of small grains had less general photosensitivity and much less red sensitivity than the average cell. An explanation is given in terms of segregation of impurities at grain boundaries. C.Hilsum

537.312.5

9651. EFFECT OF A MAGNETIC FIELD ON THE SENSITIVITY OF A SELENIUM PHOTOELECTRIC CELL. G.Blet and J.Vincent.
J. Phys. Radium, Vol. 19, No. 10, 790-2 (Oct., 1958). In French.

If the plane of the cell was parallel to the field there was a decrease in the photocurrent when the field was applied. The decrease was not strongly wavelength dependent for wavelengths from 4000 to 6000A, but then rose steeply to a maximum at 7400 A. The dependence on the strength of the magnetic field was also investigated. The effect is said to be due to a decrease in quantum efficiency.
C.Hilsum

537.312.5

9652. SURFACE POTENTIAL, FIELD-EFFECT MOBILITY, AND SURFACE CONDUCTIVITY OF ZnO CRYSTALS. H.J.Krusemeyer.
Phys. Rev., Vol. 114, No. 3, 655-64 (May 1, 1959).

Measurements of surface properties of ZnO crystals were mad at 300°K, both in dry O_2 and in high vacuum. The dark conductivity was changed by illumination with ultraviolet. Surface potentials of crystals with diameters down to 0.002 cm were measured by the Kelvin method with a sensitivity of 0.002 V. Comparison of the measured and calculated dependence of dark conductivity on dark surface potential showed that the latter could be changed from about 0.1 V to 0.5 V above the neutral point. Application of a transverse electric field produces a fast change in conductivity in less than 50 μsec and a slow change in which part of the fast change decays with a time constant ranging from minutes to hours depending an ambient and surface potential. The field effect mobility increases with increasing surface potential from a value which is sometimes small than one to a plateau value between 70 and 145 $cm^2V^{-1}sec^{-1}$ and decreases again for the largest value of surface potential. Evidence is given that the low mobility values are caused by surface states. Combined measurements of surface potential, field-effect mobility, and surface conductivity together with quantum efficiency measurements of the surface conductivity by Collins and Thomas yield the quantum efficiency of the hole-trapping process at the surface which is approximately 1 for a neutral surface. A quantitative treatment of the hole-trapping process is in good agreement with the experimental results and shows that the bulk diffusion length for holes is > 1000 A and that the ratio of hole surface trapping velocity and diffusion constant equals 1.7×10^5 cm^{-1}.

537.312.5

9653. PHOTOCONDUCTIVITY IN ZINC TELLURIDE.
Y.Simon and J.Bok.
C.R. Acad. Sci. (Paris), Vol. 248, No. 15, 2176-8 (April 13, 1959). In French.

The spectral sensitivity of photoconductivity in pure crystals of ZnTe shows a sharp peak at a photon energy of 2.08 eV, represen ting the width of the forbidden band. Dark and illuminated I—E characteristics obey Ohm's Law for fields E up to about 100 V/cm, but for stronger fields the slope of a graph of log I v. log E is greater than unity. It is suggested that this increase in conductivity is due to an increase in the number of carriers due to ionization of lattice atoms by collision. C.H.B.Me

537.312.

9654. PHOTOCONDUCTION AND CIS-TRANS ISOMERISM IN β-CAROTENE. B.Rosenberg.
J. chem. Phys., Vol. 31, No. 1, 238-46 (July, 1959).

For previous work, see Abstr. 7012 (1958). A discussion is given of some theoretical and experimental aspects of photoconductivity in β-carotene. It is shown that re-solidification of crystalline β-carotene results in the formation of a glass state whi is photoconductive. The original all trans form is converted into a mixture of stereoisomers in the glass, and the appearance of the "cis peak" at 3500 A in the optical absorption spectrum is noted. The photoconductive action spectrum of a sandwich-type cell of the β-carotene glass has a maximum in this cis peak region when the electrodes are biased in the forward rectifying direction. The inte pretation given to this in terms of the triplet state theory of photoconduction is that intersystem crossing is more probable from the cis peak than from the first excited state. Some evidence exists from semiconduction and phosphorescence measurements that the active triplet state lies 3.0 eV above the ground state and thus falls in the region between the two singlet excited states. Thus, the temperature dependent Boltzmann factor may be largely responsible fo the increase in intersystem crossing from the cis peak state. The photocurrent in the back rectification direction is shown to be due the light which is mostly transmitted through the glass and absorbe at the positive rear electrode. For strongly absorbed wavelengths the rectification ratio is 1.6×10^5. The voltage dependence is described by the sum of a linear term and a three halves power term, the former of which dominates at low field strengths and low absor tion of the exciting light. There is a linear dependence of the phot current upon intensity. The similarity of the effects of cis-trans isomerization in phosphorescence and photoconductive studies strongly suggests that the intersystem crossing to the triplet state is the dominant element in common and is considered as strong corroborating evidence for the triplet state theory of photoconducti in organic materials.

537.312.5 : 535.371

RELATIONSHIP BETWEEN THE DECAY LAWS FOR PHOSPHOR-SCENCE AND PHOTOCONDUCTIVITY. See Abstr. 9480

537.312.62

655. CRITICAL FIELD STRENGTH OF SUPERCONDUCTING OLLOW CYLINDERS IN A TRANSVERSE MAGNETIC FIELD.

.Jaggi, J.Müller and R.Sommerhalder.

elv. phys. Acta, Vol. 31, No. 6, 637-40 (1958). In German.

The pure tin specimen had the dimensions of 8 mm i.d., 8.8 mm .d., 50 mm length. Hemispherical caps were soldered tightly to e ends. Under these conditions the transition began at an applied eld of half the critical value, as is the case with a solid cylinder. the end caps were omitted, or only pushed on, penetration started t lower fields, in quantitative agreement with Serin et al (Abstr. 335 of 1954). If the edges of the cylinder were conically bevelled ven lower critical fields were observed. The paper attacks the ermodynamic argument given loc. cit., according to which in a ollow superconducting cylinder exposed to a transverse magnetic eld after cooling the free energy of the normal state becomes less an that of the superconducting state at applied fields below half e critical magnetic field. It is shown that if a longitudinal magnetic eld of the critical value is frozen in inside a hollow cylinder the xternal field that destroys superconductivity is independent of the ickness of the wall (see following abstract). H.London

537.312.62

656. CRITICAL FIELDS OF SUPERCONDUCTIVE HOLLOW YLINDERS IN TRANSVERSE MAGNETIC FIELDS.

.Serin, E.A.Lynton and J.Gittleman.

elv. phys. Acta, Vol. 32, No. 2, 138-40 (1959).

In reply to the arguments in the preceding abstract, the authors oint out that in both their own experiments, and those of Jaggi et al., here was no frozen-in magnetic field and that therefore the criticism oes not apply. H.London

537.312.62

657. SUPERCONDUCTIVITY IN THE Pd—Se SYSTEM.

.T.Matthias and S.Geller.

. Phys. Chem. Solids, Vol. 4, No. 4, 318-19 (1958).

From an experimental study, the authors come to the following onclusions. The $Pd_{1.1}Se$ phase becomes superconducting at a omposition higher in Pd than that of the ideal formula. In addition he $Pd_{2.8}Se$ phase is superconducting and probably has a higher trans-tion temperature when its composition differs from that of the ideal ormula of that phase. The phases Pd_4Se and $PdSe_2$ are not super-onducting above 1.5°K. H.London

537.312.62

658. IMPURITY EFFECTS ON THE SUPERCONDUCTIVE RITICAL TEMPERATURE OF INDIUM AND ALUMINUM.

.Chanin, E.A.Lynton and B.Serin.

hys. Rev., Vol. 114, No. 3, 719-24 (May 1, 1959).

The effects of 0.01 to 1.0 atomic % of various impurities on the uperconductive critical temperature of indium and aluminium were ound to be strikingly similar to those previously reported for tin. or sufficiently small amounts of all solutes there is an electronic nean free path effect on the critical temperature such that T_c lecreases linearly with increasing reciprocal free path. For larger mpurity concentrations the curves of critical temperature versus oncentration fall into groups according to the valence difference etween solvent and solute. T_c has a sharp upward trend for higher alence solutes; for those with lower valence the curves of T_c tend o flatten out. The similarity of these impurity effects for three uch different superconductors suggests that they are a fundamental roperty independent of the detailed nature of the superconductor.

537.312.62

659. ON THE THEORY OF SUPERCONDUCTING ALLOYS.
. THE ELECTRODYNAMICS OF ALLOYS AT ABSOLUTE ZERO.

.A.Abrikosov and L.P.Gor'kov.

h. eksper. teor. Fiz., Vol. 35, No. 6(12), 1558-71 (1958). In Russian.

A theory of superconductors containing impurities at zero tem-erature is presented. The dependence of the penetration depth on he impurity concentration is examined supposing the concentration o be small. The electrodynamic equations in alternating field have een obtained for superconductors having the electron free path maller than the correlation length.

537.312.62

660. SUPERCONDUCTING ALLOYS AT NON-ZERO EMPERATURES. A.A.Abrikosov and L.P.Gor'kov.

h. eksper. teor. Fiz., Vol. 36, No. 1, 319-20 (1959). In Russian.

The present theory of the electrodynamics of superconductors containing small quantities of impurity is extended to non-zero temperatures on the basis of the thermodynamic formulation suggested by Matsubara (Abstr. 6397 of 1956). The calculations are similar to those for T = 0 (see preceding abstract) except that a certain integral is replaced by a sum. It is concluded that small quantities of impurity have no effect on the thermodynamic functions. The behaviour of alloys in a constant magnetic field is also considered and an expression for the penetration depth in both the London and Pippard regions is derived. Expressions for the dielectric constant and magnetic susceptibility of thin films of thickness $d \ll \delta$, the penetration depth, are derived. M.G.Priestley

537.312.62

9661. THE COMPENSATION EQUATION IN SUPERCONDUCTIVITY THEORY. D.V.Shirkov.

Zh. eksper. teor. Fiz., Vol. 36, No. 2, 607-12 (1959). In Russian.

A relation is established between the matrix elements of the variational derivatives of the scattering matrix and the energy operator. With help of this relation, the kernel of the integral equation for the compensation of "dangerous" diagrams is expressed through the usual Green's functions.

537.312.62 : 536.77

9662. ON A THEOREM OF BLOCH'S. F.Engelmann.

Z. Phys., Vol. 155, No. 3, 275-80 (1959). In German.

It is pointed out that the theorem, stating that the state of lowest free energy corresponds to zero current, is a direct consequence of the symmetry of a problem against reversal of motion. Thus it becomes possible to enlarge and delimit its sphere of validity. It follows that Bloch's theorem does not contradict the hypothesis of spontaneous currents.

537.312.62 : 536.7

9663. THE THERMODYNAMIC FUNCTIONS OF THE SUPERCONDUCTOR. B.Mühlschlegel.

Z. Phys., Vol. 155, No. 3, 313-27 (1959). In German.

Gives a simplified treatment of the thermodynamics of the B.C.S. theory. It is shown that all functions can be represented with the help of a function a(x) and its derivatives. Newly calculated tables of thermodynamic functions are given.

537.312.62 : 621.373.43

9664. A CRYOGENIC OSCILLATOR. G.B.Rosenberger.

I.B.M. J. Res. Developm., Vol. 3, No. 2, 189-90 (April, 1959).

A working model of a simple relaxation oscillator is described. It is based on a relaxation process in the transition between the superconducting and conducting phases of a Pb film. An evaporated Pb conductor is shunted with a thin Cu wire, and direct current is supplied to the device, which operates at liquid He temperatures. The current switches cyclically between the Pb and the Cu conductors, when the supply current exceeds the critical current for superconductivity. The magnitude of the applied current determines the relaxation frequency of the device. J.B.Birks

537.312.62 : 534.23

ULTRASONIC ATTENUATION OF METALS AT LOW TEMPERATURES. See Abstr. 9330

537.312.8 : 539.52

9665. CONTROLLING THE ELECTRICAL AND MECHANICAL PROPERTIES OF BISMUTH BY MEANS OF SMALL ADDITIONS OF NICKEL. H.Krüger and G.Lautz.

Abhandl. Braunschw. Wiss Gesell., Vol. 8, 130-41 (1956). In German.

A thorough and systematic analysis is given of the electrical and mechanical properties of Bi—Ni alloys. Preparation methods are discussed in detail together with metallurgical and X-ray investigations into the structure of alloys with Ni-contents final to 3.5 atomic per cent. Measurements of the magnetoresistance $\Delta\rho/\rho_0$ at room temperature and at the temperatures of liquid hydrogen confirm generally the expectation of a large decrease on $\Delta\rho/\rho_0$ with increasing Ni concentration. Nevertheless, at 77°K there is in increase in $\Delta\rho/\rho_0$, possibly connected with a substitution mixed crystal of the otherwise unsoluble Ni in the Bi lattice. The ductility of the alloys was tested by bonding wires produced by pressing the material under 120 kp/mm^2 through a nozzle of 1 mm diameter. The ductility is a monotonic decreasing function with increasing Ni content up to 0.7 weight % Ni, if the pressure form is not warmed up. However, if the production of the wires is realized at 90°C an alloy with 0.15 weight % Ni is more ductile than a specpure Bi specimen. The absolute value of the ductility is lower than that of a pure Bi wire manufactured at room temperature. These experiments are discussed also in connection with some preliminary results on wires produced by cooling the nozzle to liquid air temperature. These investigations show that the Bi is more convenient for a galvanomagnetic amplifier when it contains a small amount of Ni and the wire itself is manufactured by cold working below room temperature.

537.312.8

9666. PHONON-DRAG THERMOMAGNETIC EFFECTS IN N-GERMANIUM. T.H.Geballe, C.Herring and J.E.Kunzler.
J. Phys. Chem. Solids, Vol. 8, 347-53, 361-2 (Jan., 1959).

Rochester Semiconductors Conference Paper (see Abstr. 4569 of 1959). An investigation of the thermomagnetic properties of extrinsic germanium shows that the phonon-drag contribution far outweighs that due to electron diffusion at all temperatures except when near intrinsic. All the results are understandable theoretically in terms of a model which assigns to each ellipsoidal energy shell in crystal-momentum space an anisotropic phonon-drag Peltier tensor. The temperature and energy dependence of the two components of this tensor give valuable information on the law of phonon-phonon scattering. The transverse high-field magnetoresistance, and at high temperatures the thermomagnetic effects, are found to be sensitive to small amounts of surface conduction.

537.312.8

9667. HALL EFFECT, RESISTIVITY, AND MAGNETORESISTIVITY OF Th, U, Zr, Ti, AND Nb. T.G.Berlincourt.
Phys. Rev., Vol. 114, No. 4, 969-77 (May 15, 1959).

These properties were studied at temperatures between ~ 1°K and room temperature and in magnetic fields up to 30 kilogauss. Strong temperature and purity dependences were observed in the Hall coefficients of U, Ti, and Zr. In addition, the Hall coefficient of Zr was strongly dependent upon the magnetic field strength at liquid helium temperatures. Comparisons with theory have been carried out, and it is concluded that existing theories are not sufficiently general to account quantitatively for the observed temperature and magnetic field dependences of the Hall effect and resistivity. Unusual behaviour was observed in the magnetic-field-induced superconducting transition of Nb.

537.312.8

9668. ON THE ANOMALOUS GALVANOMAGNETIC PROPERTIES OF METALS AT LOW TEMPERATURES.
N.E.Alekseevskii, N.B.Brandt and T.I.Kostina.
Zh. eksper. teor. Fiz., Vol. 34, No. 5, 1339-41 (May, 1958).
In Russian. English summary: PB 141052T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Anomalous variations of the galvanomagnetic properties of bismuth with magnetic field (for relatively small fields) are discussed. Specimen shape and position and size of electrodes are considered. L.Pincherle

537.312.8

9669. THE HALL EFFECT OF BISMUTH FILMS DEPOSITED ON COLD SUBSTRATES. W.Buckel.
Z. Phys., Vol. 154, No. 4, 474-85 (1959). In German.

Bismuth, condensed from the vapour on a substrate at 4°K, forms an amorphous structure which is superconducting below about 6°K. On heating to about 20°K a transition to the normal crystalline structure takes place. The Hall effect has been measured on such films and was found to be 10^4 times smaller for the amorphous form. The change is attributed to a much higher concentration of free electrons and an interpretation in terms of the lattice structure is attempted. K.W.Plessner

537.312.9

9670. TRANSIENT EFFECTS OF MECHANICAL DEFORMATION ON THE ELECTRICAL CONDUCTIVITY OF LITHIUM FLUORIDE AND ALKALI HALIDES. H.Curien and Z.Mihailovic.
J. Phys. Radium, Vol. 19, No. 10, 794-6 (Oct., 1958). In French.

The crystal was held at 600°C and a gramophone needle pressed into it near one electrode. If the electrodes were short-circuited a current pulse of a few microamps passed. If a voltage was applied between the electrodes the current decreased suddenly when the deformation occurred, and then slowly returned towards the original value. C.Hilsum

537.324 : 536.5

REMOVAL OF HEAT FROM THERMOELECTRIC COOLING DEVICES. See Abstr. 9559

537.361

9671. STREAMING CURRENTS WITH NONAQUEOUS SOLUTIONS
A.J.Rutgers, M.De Smet and W.Rigole.
J. Colloid Sci., Vol. 14, No. 3, 330-7 (June, 1959).

Streaming currents have been measured in benzene solutions of tetraisoamyl ammonium picrate between 10^{-7} and 10^{-3} mole/litre in long capillaries of various widths and wide capillaries of various lengths. A considerable influence of width and length was found. High ζ-values (−280 mV) were obtained at low concentrations. The corresponding theory is developed; over the length of a glass capillary an electrostatic potential V(x) develops, which shows resemblance to a catenary; measurements confirmed the theoretical explanation.

ELECTRIC DISCHARGES

537.521

9672. THEORY OF THE RETROGRADE MOTION.
G.Ecker and K.G.Müller.
J. appl. Phys., Vol. 29, No. 11, 1606-8 (Nov., 1958).

Using field-stabilized cathode mechanism as basis, retrograde motion is accounted for without additional assumption. Results of further calculations prove to be strongly dependent on electron—ion coupling. Agreement with experimental data is within an order of magnitude; curves shown are normalized at one point. A.E.D.Heyle

537.523

9673. CURRENT DENSITIES IN THE ANODE SPOTS OF SPARK DISCHARGES IN AIR AT ATMOSPHERIC PRESSURE. K.Šobra.
Czech. J. Phys., Vol. 7, No. 3, 311-19 (1957). In Russian.

Current densities were measured using a photographic method. It is shown that current density in the anode spot remains constant throughout the discharge. The spots can be divided into two groups: circular with smooth edges formed mainly on materials crystallizin in cubic lattices, and spots having complicated shapes on materials crystallizing in non-cubic lattices. The current densities are correlated with the atomic diameter and the number of valency electrons of the anode material. Z.Krasuck

537.523.

9674. NATURE OF AN ARC DISCHARGE IN AN ATMOSPHERE OF INERT GASES. V.N.Egorov, V.N.Kolesnikov and N.N.Sobolev.
Dokl. Akad. Nauk SSSR, Vol. 121, No. 3, 440-2 (1958). In Russian.

It is shown that there is no thermal equilibrium in a low currer arc between carbon electrodes in inert gases at normal pressures. Z.Krasuck

537.523.74 : 539.19

DISSOCIATION OF HYDROGEN IN A MICROWAVE DISCHARGE
See Abstr. 8698

537.52

9675. EMPIRICAL RELATIONS FOR MOVING STRIATIONS.
K.G.Emeleus and N.L.Oleson.
Proc. Phys. Soc., Vol. 73, Pt 3, 526-8 (March, 1959).

The empirical relationships, found by earlier workers, betwee the various quantities describing moving striations are re-examine and the following equations obtained: $fRM = 6.14 \times 10^4 A^{-2}/(pR\ V_i)$ where f is frequency of striations; R is radius of long cylindrical discharge tube, in cm; M is atomic weight of gas; p is pressure i mm of Hg; V_i is ionization potential in volts and A is a constant such that $\lambda = AR$ where λ is the distance between striations. Devi tions from this equation are discussed for the case of the rare gase P.A.You

537.52

9676. INVESTIGATION OF BREAKDOWN IN VACUUM.
E.S.Borovik and B.P.Batrakov.
Zh. tekh. Fiz., Vol. 28, No. 9, 1971-80 (1958). In Russian.

Surface breakdown in vacuum takes place along narrow channe on the surface of the insulator. Of a dozen insulators tested, Plexi glas and Viniplast had the greatest strength. In breakdown of vacuum gaps, pre-breakdown electron current is observed. Increa ing the degree of degassing of the electrodes does not increase the electric strength of the vacuum gap. The breakdown of an insulato and that of a vacuum gap are not dependent on pressure in the rang 10^{-6} to 10^{-8} mm Hg. Z.Krasuc

537.525 : 539.1.07

THEORY OF DISCHARGE SPREAD IN GEIGER-COUNTERS. See Abstr. 8399

537.525 : 539.1.07

AUTOMATIC CLOUD CHAMBER FOR GAS DISCHARGE STUDIES. See Abstr. 8418

537.525.5 : 537.56

9677. ON THE PROBLEM OF AMBIPOLAR DIFFUSION IN A MAGNETIC FIELD. A.V.Nedospasov.
Zh. eksper. teor. Fiz., Vol. 34, No. 5, 1338-9 (1958). In Russian. English summary: PB 141052T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The distribution of ion current density on the wall in a low voltage arc was measured for different values of the applied longitudinal magnetic field, using a method described earlier. The variation with magnetic field of the ratio of ambipolar diffusion parallel and perpendicular to the field was deduced and found to agree with the classical picture. The concentration of electrons in the plasma need not be measured. A.E.D.Heylen

537.525.5 : 541.183 : 621.387

9678. ADSORPTION OF GASES IN THE LOW-PRESSURE [Hg-VAPOUR] ARC. E.Ya.Pumper.
Zh. tekh. Fiz., Vol. 28, No. 10, 2275-81 (1958). In Russian.

Continues Deck's measurements (Abstr. 706 of 1944) of the adsorption of air, N, CO_2 and A by anode, glass wall and cathode. Details of tests arrangements and procedure are given. All gases except A are adsorbed rapidly within a few minutes after the arc current of 1.5-10 A is switched on. With initial pressures of up to 400 micron the residual pressure is less than 10 microns. The adsorbed quantities are analysed in terms of the number of molecular layers on the surface which is of the order of 300 for the anode and 10 for the glass wall. A tentative explanation of the observed phenomena is given. F.Busemann

537.525.8

9679. IMPEDANCE AND RECOVERY TIME OF GLOW DISCHARGES IN MIXTURES OF RARE GASES.
G.Ahsmann and H.J.Oskam.
J. appl. Phys., Vol. 29, No. 12, 1768 (Dec., 1958).

Complex impedance of glow discharge in rare gases is considerably reduced by addition of another rare gas of lower ionization potential than that of the main gas. Impedance as a function of frequency (150-5000 c/s) in pure helium and in helium with 1 and 5% neon is shown to agree with theory (Abstr. 3740 of 1939). A.E.D.Heylen

537.529

9680. SURFACE BREAKDOWN OF POLYCRYSTALLINE DIELECTRICS OF DIFFERENT PERMITTIVITIES. A.N.Gubkin.
Zh. tekh. Fiz., Vol. 28, No. 10, 2194-9 (1958). In Russian.

The dependence of surface breakdown of ceramic dielectrics on frequency, homogeneity of the field, pressure and relative humidity of air was studied. It is shown that the surface breakdown strength of dielectrics of very high permittivity is reduced at 100 kc/s and higher frequencies. Z.Krasucki

X-RAYS

537.531 : 535.34

9681. FINE STRUCTURE OF THE X-RAY K ABSORPTION SPECTRA OF TITANIUM IN THE FORM OF THE TITANATE.
É.E.Vainshtein, M.N.Bril' and I.B.Starȳi.
Dokl. Akad. Nauk SSSR, Vol. 122, No. 2, 201-3 (1958). In Russian.

Briefly describes the accurate determination of the K absorption spectra of titanium in the form of titanates, e.g. of iron, strontium, magnesium, and zinc. An interpretation of the variations of fine structure is given. T.Mulvey

537.531 : 535.34

9682. FINE STRUCTURE OF THE X-RAY K ABSORPTION SPECTRA OF TITANIUM IN THE CARBIDE STATE.
É.E.Vainshtein, I.B.Starȳi and E.A.Zhurakovskii.
Dokl. Akad. Nauk SSSR, Vol. 122, No. 3, 365-6 (1958). In Russian.

Short communication describing detailed measurement of the titanium K absorption edge of the system titanium—carbon, with carbon varying from 12-24%. A quartz crystal spectrograph was used with a resolution of 2.5 × μ/mm. Comparison is made between the K absorption edge of titanium in the form of the carbide or the oxide. T.Mulvey

537.531 : 535.333

9683. X-RAY L SPECTRAL SERIES OF CeB_6 AND CeO_2.
N.V.Troneva, I.D.Marchukova and I.B.Borovskii.
Fiz. Metallov i Metallovedenie, Vol. 6, No. 1, 141-7 (1958). In Russian.

By measuring and analysing the LIII absorption edge and the $L\beta_2\beta_{10}$ emission band of CeB_6 and CeO_2 the influence of chemical bonding in the X-ray spectrum is shown experimentally for the rare earth group. A.E.I. Research Laboratory

537.531 : 621.386.1

9684. THE INPUT POWER LIMIT OF THE CYLINDRICAL ROTATING ANODE OF AN X-RAY TUBE.
T.Ishimura, T.Shiraiwa and M.Sawada.
J. Phys. Soc. Japan, Vol. 12, No. 10, 1064-70 (Oct., 1957).

The permissible maximum input power of the cylindrical anode of a continuous operating X-ray tube was calculated. Calculation was made for the cyclic dynamical steady state which was realized after sufficiently long continuous operation. This thermal problem was treated by DuMond as a one-dimensional problem in which heat flow was normal to the surface of the target. In the present case a focus of an electron beam was a line focus and the width was small compared with the thickness of the target and the problem was treated as a two-dimensional problem containing transversal thermal flow.

537.531

9685. FINE-FOCUS X-RAY TUBE WITH AN ADSORPTION PUMP.
V.S.Kogan, V.P.Selivanov and R.F.Bulatova.
Pribory i Tekh. Eksper., 1959, No. 1, 145-7 (Jan.-Feb.). In Russian.

Describes an X-ray tube with a focal spot of about 100 μ diameter. The diffusion pump is dispensed with and is replaced by a liquid nitrogen trap. T.Mulvey

537.531 : 535.33.07 : 548.5

POSSIBLE USE OF GERMANIUM CRYSTALS IN X-RAY SPECTROMETERS. See Abstr. 8989

ELECTRON EMISSION . ELECTRON BEAMS

537.533 : 539.1.07

USE OF OPEN GEIGER COUNTERS IN COLD EMISSION STUDIES. See Abstr. 8398

537.533 : 621.385.1

9686. ELECTRON EMISSION OF MATERIALS FOR ELECTRON TUBES. G.A.Espersen and J.W.Rogers.
Philips tech. Rev., Vol. 20, No. 9, 269-74 (1958-59).

An investigation was made into the emissive properties of various materials. Special tubes were built for this purpose, care being taken to ensure that all parts were scrupulously clean. To simulate practical operating conditions, cathode evaporation products were allowed to form deposits on the grid. Measurements were also carried out at different operating temperatures. Three types of cathode were used, viz. impregnated cathodes, L cathodes and oxide cathodes. Clean titanium was found to have the lowest emission of all materials tested. It shows a much greater emission, however, if coated with titanium oxide.

537.533

9687. THE PROBLEM OF THE ELECTRON EMISSION OF NICKEL IN THE CURIE REGION. F.Fraunberger and A.Kellerer.
Z. Phys., Vol. 154, No. 4, 419-22 (1959). In German.

No anomaly in exo-electron emission is found for nickel specimens on passing through the Curie temperatures. G.F.J.Garlick

537.533 : 537.311.33 : 621.385.032.213.13

9688. A NOTE ON THE ROLE OF COLLOIDAL PARTICLES IN THE ELECTRO-CONDUCTION AND THERMO-EMISSION OF SEMICONDUCTOR CATHODES. I.M.Dȳkman and E.I.Kaplunova.
Radiotekhnika i Elektronika, Vol. 3, No. 8, 990-9 (1958). In Russian.

A semiconductor cathode containing R excess metal atoms per unit volume, where the number R is assumed independent of temperature changes, is considered. The excess metal can be in two phase states, colloidal and atomic. The atomic state may be in the form of (a) excess atoms in interstitial spaces or (b) anionic vacancies. The colloidal particles form round certain centres of attraction, and it is assumed for simplicity that the number n of metal atoms at these centres is constant, whilst temperature changes lead only to a change in the total number of colloidal particles. The chemical potential of the two phase states must be equal at thermodynamic equilibrium and its value is calculated for cases (a) and (b) above; hence the concentration of each phase is obtained as a function of temperature. The chemical potential is calculated for different temperatures and different semiconductor parameters (4 combinations of $\epsilon = -1.6$ and -2 eV, $\mu_0 = -1.3$ and -2 eV, where ϵ = atomic and μ_0 = colloidal electron energy level). Hence four laws are established for electro-conduction and thermal emission, in reference to the presence of colloidal particles. The effect of colloidal particles on the spotty structure of the cathode is also indicated.

D.E.Brown

537.533 : 536.422.1

9689. THE EVAPORATION OF OXIDE COATED CATHODES. I.

J.Ádám, K.Ettre, G.Gergely and P.F.Váradi.
Z. phys. Chem. (Leipzig), Vol. 207, No. 1-2, 70-80 (June, 1957).

The evaporation of Ba, Sr and Ca oxide coated cathodes was studied by a flame-photometric method. A specially built experimental tube was used for the evaporation studies. The evaporation products were collected by quartz targets. The temperature of the cathodes was determined by an optical pyrometer. The emissivity of the cathodes was determined by a demountable vacuum system, similarly to Moore and Allison. A detailed description is given of the flame-photometric analysis and the interference effect in flame-photometry. The problems of experimental errors are discussed.

537.533 : 621.385.032.213.13

9690. PRECONVERSION OF OXIDE CATHODES.

G.A.Haas and J.T.Jensen,Jr.
Rev. sci. Instrum., Vol. 30, No. 7, 562-5 (July, 1959).

It has been shown that the organic contaminants released during the carbonate and binder decomposition of conventional oxide cathodes can be eliminated if the cathode is preconverted in a separate envelope and is then transferred to the final tube as the alkaline-earth hydroxide. The technique used in accomplishing this lends itself readily to many laboratory applications where tube cleanliness is important. Specific applications to thermionic and secondary emission studies are described. The results indicate a definite reduction in the contamination of tube components and show improved cathode characteristics.

537.533

9691. PROPERTIES OF A THERMOELECTRIC CELL.

G.M.Grover, D.J.Roehling, E.W.Salmi and R.W.Pidd.
J. appl. Phys., Vol. 29, No. 11, 1611-12 (Nov., 1958).

A thermionic generator, with a tantalum emitter spaced 1 cm away from a copper collector, was operated when filled with caesium vapour at pressures ranging from 10^{-6} to 1 mm Hg. The peak power observed was 10 W/cm^2 of emitter, with a maximum short circuit current of 40 A. The efficiency was 5%.

C.Hilsum

537.533

9692. PHOTOELECTRIC INVESTIGATION ON EVAPORATED Ni, Bi AND Ge FILMS.

R.Suhrmann and L.van Lessen.
Abhandl. Braunschw. Wiss. Gesell., Vol. 10, 35-46 (1958).
In German.

The films were evaporated on cooled glass surfaces (90°K) in high vacuum. The quantum yield for the emission of photoelectrons is measured before (disordered film) and after tempering at 298°K (ordered film). The work function Φ of the disordered Ni film is smaller by 0.4 V than that of the same film in the ordered state. The activation energy for crystallization is 803 cal/mol. The representation of the spectral photoelectric sensitivity of the semiconducting films of Bi and Ge needs two values Φ_1 and Φ_2 and two constants M_1 and M_2, which measure the number of the centres emitting electrons. The variation of these constants with temperature and crystallization is discussed in terms of semiconductor theory.

537.533 : 539.217

DIFFUSION OF ACTIVATOR OF CATHODE SLEEVE. See Abstr. 8880

537.533

9693. PHOTOELECTRIC EMISSION OF OXIDE COATED CATHODES.

T.Yabumoto and S.Yamada.
J. Phys. Soc. Japan, Vol. 12, No. 10, 1163 (Oct., 1957).

The room temperature spectral sensitivity of photoemission from a (BaSr)O cathode which had been exposed to oxygen at a pressure of about 10^{-6} mm Hg showed a peak at an incident photon energy of about 4.7 eV. This peak could be removed by annealing at 700°K or by oxygen treatment at a higher pressure (10^{-5} mm Hg). It is supposed that the peak is due to photoemission from a level about 0.3 eV above the top of the filled band; this level may be either a surface state, due to oxygen adsorption, or an acceptor level.

C.H.B.Mee

537.533 : 621.383.032.21

9694. SEMI-TRANSPARENT PHOTO-CATHODES FOR DETECTING ULTRAVIOLET RADIATION.

T.M.Lifshits and N.G.Kokina.
Radiotekhnika i Elektronika, Vol. 3, No. 10, 1315 (Oct., 1958).
In Russian.

Preliminary results on semi-transparent magnesium and magnesium—silver photo-cathodes for ultraviolet light are given. Magnesium cathodes have a sensitivity of 0.2 μA/mW and magnesium—silver cathodes a sensitivity of 0.6 μA/mW.

R.C.Glass

537.533 : 539.1.0

9695. PRODUCTION OF PHOTO[ELECTRON]-MULTIPLIERS AND THEIR ELEMENTARY PARAMETERS.

A.E.Melamid.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 1, 78-82 (1958).
In Russian. English summary: PB 141041T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The elementary parameters of a photomultiplier, which depend on the photocathode, the electron optics and the dynode structure, are considered. These include sensitivity, quantum yield and uniformity of the cathode; electron collection efficiency and uniformity; gain of the dynode system; and the dark current. It is shown that the cathode activation process, rather than the cathode thickness, determines the variations in sensitivity. Since the resolving power of a scintillation spectrometer is influenced by the scintillator, the resolving power of a photomultiplier is measured using uniform light flashes. To obtain best resolution, it is necessary to select an optimum voltage distribution at the focusing electrodes. The dark current consists of two components, due to leakag current in the collector circuit, and due to amplified thermionic emission. In scintillation counting, the latter is more important, and is best expressed as a pulse height distribution, dependent on the cathode nature, surface and temperature, and not as an integrat current. It is emphasized that only photomultipliers satisfying all the basic requirements are suitable for scintillation spectrometry. Data are given (7 figures, 2 tables) for the $\Phi \ni \gamma - 1$ C and −19 photomultipliers.

J.B.Birk

537.533 : 539.1.0

IMPROVED PERFORMANCE OF PHOTOMULTIPLIERS IN SCINTILLATION COUNTERS. See Abstr. 8410

537.533 : 541.18

PHOTOEMISSION FROM HYDROGEN ATOMS ADSORBED ON SILICON. See Abstr. 8976

537.53

9696. THE PROBLEM OF THE DEPTH OF SECONDARY ELECTRON FORMATION IN DIELECTRICS.

N.L.Yasnopol'skii and A.E.Shabel'nikova.
Radiotekhnika i Elektronika, Vol. 3, No. 10, 1314 (Oct., 1958).
In Russian.

The dependence of secondary electron emission depth on primary electron energy was investigated for aluminium oxide on an aluminium base. The depth was found to be of the order of a micron. The mechanism of the emission is discussed.

R.C.Glas

537.533 : 551.510.535 : 539.1

MEASUREMENTS OF SECONDARY ELECTRON EMISSION FROM A METAL PLATE PRODUCED BY ION BOMBARDMENT. See Abstr. 8692

537.533 : 621.385.642.3

97. THE THEORY OF A SPLIT-ANODE MAGNETRON.

.Ya.Mints.

h. tekh. Fiz., Vol. 27, No. 6, 1313-18 (June, 1957). In Russian. nglish translation in: Soviet Physics — Technical Physics (New ork), Vol. 2, No. 6, 1210-16 (June, 1957).

The physical assumptions are: the amplitude of the oscillations sufficiently small; the static regime can be described by diffusion eory; the attenuation decrement is much less than the frequency the oscillations; it is possible to neglect the alternating component the magnetic field. Similar results showing the excitation con-tion dependent on the attenuation decrement are found as for the ase of the cylindrical-anode magnetron. S.C.Dunn

537.533 : 621.385.833

698. TOROIDAL ELECTRON GUNS FOR HOLLOW BEAMS.

.A.Harris.

. appl. Phys., Vol. 30, No. 6, 826-36 (June, 1959).

A theory of convergent, high-efficiency electron guns for the roduction of dense hollow beams is presented. An approximate olution to Poisson's equation is obtained in a cylindrical coordinate ystem modified to account for the toroidal geometry. Experimental easurements on a series of toroidal guns tend to confirm the space-harge theory. They also show that the annular slit in the anode very eriously affects the uniformity of cathode emission and diverges the eam more than can be accounted for by present theories. These ffects of the slit appear to confine the usefulness of these guns to igh-power applications.

537.533

699. ON THE STERN—GERLACH'S EXPERIMENT FOR FREE LECTRONS. S.Yamaguchi.

. Sci. Res. Inst. (Tokyo), Vol. 51, 69-72 (June, 1957).

The spins of free electrons (wavelength, 0.03 A) were demon-trated by means of Stern—Gerlach's procedure. The steep inclina-ion of the magnetic field existing at the surface of a permanent agnet was used for polarizing an incident electron beam. The trength of the Heisenberg—Weiss molecular field was found to be $.0^7$ G.

537.533 : 621.385.032.213.13

700. IMPROVEMENT OF THE DIRECT FOCUSING CATHODE EVELOPED BY STEIGERWALD BY THE ADDITION OF A URTHER ELECTRODE. F.W.Braucks.

ptik, Vol. 16, No. 5, 304-12 (May, 1959). In German.

By including an auxiliary electrode, it is possible to increase he intensity of the directed beam and to change the distance of the smallest beam cross-section from the emitter by varying the poten-ial on the auxiliary electrode. The effect of the essential values of he design dimensions upon the current density and the intensity of he directed beam are determined. A comparison is made between he results of the improved system and those obtained with the riginal emitter [Optik, Vol. 5, 469 (1949)].

537.533

701. ON THE ELECTRON-TRAJECTORY EQUATIONS IN LECTRON-OPTICAL SYSTEMS WITH CURVED AXIS.

.P.Kas'yankov.

ptika i Spektrosk., Vol. 3, No. 2, 169-79 (Aug., 1957). In Russian.

The author derives exact relativistic equations for electron rajectories in an arbitrary electron-optical system with a curvili-ear optical axis, and shows that these equations can be simplified or the region close to the axis (the paraxial case). The trajectory quations are derived by two methods: (a) starting with the equations f motion in tensor form, and (b) using the electron-optical analogue f Fermat's principle (variational method). The author critically iscusses Grinberg's method(1948)for obtaining the paraxial electron-rajectory equations in the first-order approximation and shows that riberg's method cannot be used to derive the exact equations.

A.Tybulewicz

537.533

9702. MOTION OF ELECTRON ALONG SELF-INTERSECTING TRAJECTORIES. G.E.Zil'berman.

Zh. eksper. teor Fiz., Vol. 34, No. 3, 748-9 (1958). In Russian. English translation: Soviet Physics—JETP (New York), Vol. 34 (7), No. 3, 513-14 (Sept., 1958).

A general form of the motion of an electron along a closed self-intersecting curve is considered, including the case when this "figure-eight" trajectory has a narrow neck and breaks up into two regions. The region of applicability of the quasi-classical approximation is determined and the level separation for varying deformation of the "figure-eight". A.E.I. Research Laboratories

537.533

9703. THEORETICAL AND EXPERIMENTAL STUDY OF THE FIELD OF A SERIES OF MAGNETIC CYLINDRICAL LENSES.

P.Gautier and C.Latour.

C.R. Acad. Sci. (Paris), Vol. 248, No. 11, 1637-40 (March 16, 1959). In French.

By means of two successive transformations the field in a magnetic cylindrical lens is calculated theoretically. The results are in good agreement with experiment and this is taken to justify the assumption that the permeability of the pole-pieces may be taken as infinite. A.E.I. Research Laboratory

537.533

9704. AN ELECTRON LENS SYSTEM EXCITED BY PERMANENT MAGNETS WITH A NEW ASTIGMATISM COMPENSATOR.

H.Kimura and S.Katagiri.

Optik, Vol. 16, No. 1, 50-6 (Jan., 1959).

In the HS-5 electron microscope (Hitachi Central Research Laboratory, Japan) all the lenses are excited by permanent magnets. The objective and projection lenses are of the single-gap type, the condenser and intermediate of the double-gap type. The construction is reported. The astigmatism of the objective lens is compensated with a new compensator. The compensator is a nickel-plated copper cylinder with a slitted head. The strength of the asymmetric magnetic field in the compensator is controlled by the thickness of plated nickel. To find quickly the compensating condition, the vector representation of the astigmatism is used.

537.533

9705. MEASUREMENT OF THE ASTIGMATISM OF ELECTROSTATIC LENSES. R.Gobrecht.

Exper. Tech. der Phys., Vol. 6, No. 6, 241-9 (1958). In German.

The astigmatic aberrations of an electrostatic immersion lens were experimentally investigated in both accelerating and retarding conditions. The aperture diameter, focal length, and distance of the object point from the axis were independently varied. Agreement with the third-order theory was reasonably good, but better for the retarding than for the accelerating lens. The Seidel coefficient S_4 is not constant but falls rapidly with increasing focal length; its value is greater for a retarding than for the corresponding accelerating lens. V.E.Cosslett

537.533

9706. MEASUREMENT OF THE MOTT ASYMMETRY IN DOUBLE SCATTERING OF ELECTRONS. D.F.Nelson and R.W.Pidd.

Phys. Rev., Vol. 114, No. 3, 728-35 (May 1, 1959).

The Mott asymmetry was observed at 121 keV for gold targets and scattering angles of $\theta_1 = 90^\circ$ and $\theta_2 = 80^\circ$ to 140°. The cosine dependence of the asymmetry on the azimuthal angle was shown in all cases. A weak magnetic lens (maximum field: 12.5 G) was used between the two scatterers, and a low-resolution (8%) electrostatic energy analyser was used after second scattering. The measured asymmetry amplitudes are compared with the calculations of Sherman (pure Coulomb field) and of Mohr and Tassie (screened Coulomb field). The experimental values for $\theta_2 = 90^\circ$, 100°, 110° agree well with either theoretical curve but are not accurate enough to distinguish between them. The measured value at $\theta_2 = 80^\circ$ is enough higher (17%) than the pure Coulomb field curve to indicate a screening effect. The experimental values for $\theta_2 = 120^\circ$, 130°, and 140° fall from 15% to 20% below the theoretical curves. This discrepancy is attributed to plural scattering. Measurements made using the magnetic lens but not the energy analyser yield asymmetries reduced in amplitude about 33% and shifted in phase by 26° when compared with the measurements discussed above. This is believed due to the presence of an appreciable number of polarized electrons at a considerably lower energy than 121 keV in the first scattered beam.

537.533 : 539.23

INFLUENCE OF THE SCATTERING ANGLE ON THE ENERGY SPECTRUM OF A BEAM OF ELECTRONS TRANSMITTED BY A THIN FILM. See Abstr. 8903

537.533 : 539.21

9707. CHARGE DISTRIBUTION AND RANGE EFFECTS PRODUCED BY 3 MeV ELECTRONS IN PLEXIGLAS AND ALUMINUM.

B.Gross and K.A.Wright.

Phys. Rev., Vol. 114, No. 3, 725-7 (May 1, 1959).

Charge distribution curves of nearly parallel beams of monoenergetic electrons of 3 MeV were measured in Plexiglas and aluminium. The charge distribution in depth reaches a maximum at approximately $\frac{2}{3}$ of maximum range. The maximum in Plexiglas is sharper than in aluminium. The results confirm the existence of a space charge layer in dielectrics after electron bombardment. The measured charge distribution reflects the differential range distribution of monoenergetic electrons

537.533 : 539.21

DISSOCIATION OF SOLID SrO BY IMPACT OF SLOW ELECTRONS. See Abstr. 8865

ION EMISSION . ION BEAMS

537.534

9708. SURFACE IONIZATION OF MOLECULES OF NaCl AND LiCl ON TUNGSTEN IN ELECTRIC FIELDS UP TO 1.3×10^6 V/cm. É.Ya.Zandberg.
Zh. tekh. Fiz., Vol. 28, No. 11, 2434-43 (1958). In Russian.

After theoretical introduction, describes experiments on the ionization of molecules of NaCl and LiCl on the surface of tungsten, in various fields between 5.5×10^4 and 1.3×10^6 V/cm, and at temperatures from 1750°K to 2650°K. It was found that the ionization current varies with temperature as in the case of a homogeneous surface having an effective work function φ^*. It follows, from the table of calculated values of φ^* for different fields, that φ^* does not vary significantly for LiCl and varies very little for NaCl. It was also found that very high fields change the character of temperature dependence of ionization of Na and Li on tungsten (ionization potential $V_i > \varphi^*$), making it similar to that in the case of K on tungsten ($V_i < \varphi^*$). The ionization current increases with the increase of field according to Schottky's formula. The cylindrical condenser method was employed in the investigation. J.M.Zarzycki

537.534

9709. SURFACE IONIZATION OF ATOMS OF LITHIUM ON POLYCRYSTALLINE TUNGSTEN IN ELECTRIC FIELDS UP TO 1.3×10^6 V/cm. E.Ya.Zandberg and N.I.Ionov.
Zh. tekh. Fiz., Vol. 28, No. 11, 2444-54 (1958). In Russian.

The temperature dependence of the ionization current formed by ionization of atoms of Li on the surface of polycrystalline tungsten, was studied at various fields between 5.5×10^4 and 1.3×10^6 V/cm. It was found that the temperature dependence at low ranges of temperature, for all values of field used, conforms to the case of a homogeneous surface with effective work function φ^*. The tabulated values of φ^* at these high temperatures agree well with values given in the preceding abstract for LiCl, and are practically independent of the magnitude of the field. Theoretical explanation of the results is given, showing that for heterogeneous surfaces with work function φ^* the effect of ionization can be expressed by an equation resembling that of Langmuir and Saha. The ionization current increases with field but generally in a more complex way than would follow from Schottky's equation. The method of the preceding abstract was used in the investigation. J.M.Zarzycki

537.534

9710. SPACE CHARGE IN EXHAUST OF MOTOR VEHICLES. C.J.Brasefield.
Science, Vol. 129, 1610 (June 12, 1959).

Exhaust gases are electrically charged, usually positively but sometimes negatively. This charge does not depend on the electric potential of the vehicle. Whether the charge is positive or negative seems to depend on whether water droplets or carbon particles predominate in the exhaust.

537.534

9711. ON THE USE OF A DIAPHRAGM INSIDE THE EXTRACTION CANAL OF AN H.F. ION SOURCE. D.Blanc and A.Degeilh.
C.R. Acad. Sci. (Paris), Vol. 248, No. 11, 1647-9 (March 16, 1959). In French.

By placing a diaphragm 1 mm in diameter in the extraction tube of an h.f. source, used to produce positive ions of argon, the gas consumption was reduced by a factor of four. A.E.I.Research Laboratory

537.534

9712. ON THE MOTION OF A PARTICLE OF RELATIVISTIC ENERGY IN THE MAGNETIC FIELD OF A COIL CARRYING A CONSTANT ELECTRIC CURRENT TOGETHER WITH A UNIFORM ELECTRIC FIELD PARALLEL TO THE AXIS OF THE COIL. A.Pignedoli.
Atti Accad. Sci. Torino I, Vol. 92, No. 2, 256-72 (1957-58). In Italian.

537.534

9713. GRAPHICAL-ANALYTICAL CONSTRUCTIONS OF TRAJECTORIES OF CHARGED PARTICLES IN ELECTROSTATIC AND MAGNETIC FIELDS. N.I.Shtepa.
Zh. tekh. Fiz., Vol. 28, No. 11, 2587-603 (1958). In Russian.

Trajectories of charged relativistic particles are considered. The method of incremental velocities and the method of radii of curvature, as well as a combination of the two, are used. The approximations involved are considered and the way of accounting for the resulting errors. Examples of trajectories constructed in this way are given. G.Martelli

537.534

9714. FOCUSING PROPERTIES OF THE BIOT-SAVART FIELD. E.R.Caianiello and G.Gatti.
Nuovo Cimento, Vol. 12, No. 5, 469-76 (June 1, 1959). In Italian.

The focusing properties of magnetic fields produced by rectilinear currents of very high intensity are investigated. The results seem to indicate that such fields might prove of practical use in the design of particle accelerators.

537.534 : 539.18

9715. A MASS SEPARATOR WITH MAGNETIC FOCUSING OF THE SECOND ORDER.
B.Arcipiani, G.Barsanti, M.Fumelli, L.Musumeci and N.Talini.
Nuovo Cimento, Vol. 12, No. 6, 611-15 (June 16, 1959). In Italian.

An electromagnetic isotope separator with a 90° analysing magnet, radius 40 cm and second-order magnetic focusing is described. Experimental results obtained with a low power ion source are presented. The device is designed for the production of very pure isotopic samples for research purposes.

537.534

9716. ON THE CORRECTION OF ABERRATIONS OF DOUBLE-FOCUSING MASS-SPECTROGRAPHS. H.Ewald.
Z. Naturforsch., Vol. 14a, No. 2, 198-9 (Feb., 1959). In German.

Earlier work by the author and Liebl on correction of aberrations in toroidal condensers and double-focusing mass-spectrometers, was based on a value of unity for the parameter R_e', which measures the radial variation of curvature of the equipotential surfaces at the symmetry plane. The advantages, design changes and tolerances involved in changing to other, and in particular negative, values of R_e' are discussed. B.Meltzer

537.534

9717. MASS-SPECTROGRAPHS WITH DOUBLE-FOCUSING OF THE SECOND ORDER. H.Liebl and H.Ewald.
Z. Naturforsch., Vol. 14a, No. 2, 199-200 (Feb., 1959). In German.

Discusses design data for mass-spectrometers, based on negative values of the parameter R_e' (see preceding abstract). B.Meltzer

PARTICLE ACCELERATORS

537.54

9718. THE DISTORTION OF THE MAGNETIC FIELD OF A STRONG-FOCUSING ACCELERATOR BY THE METAL VACUUM CHAMBER. Yu.F.Orlov and S.A.Kheifets.
Pribory i Tekh Eksper., 1959, No. 1, 21-3 (Jan.-Feb.). In Russian.

In view of the small cross-section of customary vacuum chambers, magnetic field measurements can only be made over a restricted area. The distortion of the magnetic field due to the metal walls of the chamber can however be calculated. This is done for vacuum chambers of elliptical and rectangular cross-section. The effects of the heating of the walls by the current is also considered. A.E.I.Research Laboratory

537.54 : 518.5 : 681.142 : 621.317.79

MECHANICAL ANALOGUE COMPUTER FOR SOLVING THE AXIAL EQUATIONS OF MOTION DURING BUNCHING IN LINEAR ELECTRON ACCELERATORS. See Abstr. 9131

537.54

9719. DAMPING OF THE OSCILLATIONS OF PARTICLES IN THE ELECTRON-SYNCHROTRON WITH RIGID FOCUSING. Yu.F.Orlov, E.K.Tarasov and S.A.Kheifets.
Pribory i Tekh. Eksper., 1959, No. 1, 17-20 (Jan.-Feb.). In Russian.

The methods of oscillation damping, achieved by the variation of the magnetic field along the particle orbit, are discussed. P.Roman

537.54

20. ELECTRON CAPTURE IN A BETATRON. A.N.Matveev.
. eksper. teor. Fiz., Vol. 34, No. 5, 1331-3 (1958). In Russian.
glish summary: PB 141052T-2, obtainable from Office of
chnical Services, U.S. Dept. of Commerce, Washington, D.C.,
S.A.

Criticizes a paper by Logunov and Semenov (Abstr. 5826 of 1959) a statistical capture mechanism in the betatron. Such a mechanism ld only work at higher injection electron densities than that conlered in their example. In the latter, Coulomb repulsion takes the ctrons to the walls in about 2 or less revolutions after injection, the average. B.Meltzer

537.54

21. EFFECT OF RADIATION DAMPING IN CALCULATING
IE DISPLACEMENT OF ELECTRONS AT THE TARGET IN A
TATRON. V.M.Razin.
. tekh. Fiz., Vol. 28, No. 8, 1845-8 (Aug., 1958). In Russian.
glish translation in: Soviet Physics—Technical Physics (New
rk),Vol. 3, No. 8, 1701-4 (Aug., 1958).

A method of using a supplementary increase of magnetic field the orbit circle at the end of the accelerating cycle is proposed r compensating the losses due to radiation damping and for exnding the orbit so that the accelerated electrons strike the target the desired phase of the accelerating field. The problem is scussed quantitatively. A.E.I. Research Laboratories

IONIZATION . PLASMA

537.56

22. IONIZATION AND DISSOCIATION OF MOLECULES BY
ONOENERGETIC ELECTRONS. III. ON THE EXISTENCE OF A
ENT EXCITED STATE OF NO_2^+. J.Collin.
chem. Phys., Vol. 30, No. 6, 1621 (June, 1959).

For previous work, see Abstr. 8836 (1958). The formation of O_2^+ from nitromethane using a monoenergetic electron beam has en studied. Results indicate that two states of NO_2^+ are formed ring this dissociation. G.I.W.Llewelyn

537.56 : 539.12

CHARGE TRANSFER FOR PROTONS IN H_2. See Abstr. 8455

537.56

23. MULTIPLE IONIZATION OF SODIUM VAPOR BY
LECTRON IMPACT. V.H.Dibeler and R.M.Reese.
chem. Phys., Vol. 31, No. 1, 282-3 (July, 1959).

Ionization probability curves are shown for the Na^+, Na^{++} and a^{+++} ions, the first power, square root and cube root of the espective ion currents being plotted against the electron energy. he Na^{+++} ion current follows a square law and the Na^{+++} ion rrent a cubic law to approximately 30 eV above threshold. The trapolated ionization potentials for the three ions are 5.14, 2 ± 1 and 125 ± 2 eV respectively, in good agreement with spectroopic results. A 14-stage electron multiplier replaced the usual n collector in these measurements. I.C.Demetsopoullos

537.56 : 535.325

IRRADIATED GASES. ELECTRON ATTACHMENT CROSS-
ECTION AND REFRACTIVE INDEX VARIATIONS.
ee Abstr. 9389

537.56 : 539.12

APPROACH OF ELECTRONS TO EQUILIBRIUM IN AN ION-
ED GAS. See Abstr. 8445

537.56

724. DEPENDENCE OF ELECTRON MOBILITY ON MAGNETIC
IELD IN A FULLY IONIZED GAS. M.S.Sodha and Y.P.Varshni.
hys. Rev., Vol. 114, No. 4, 946-7 (May 15, 1959).

The variation of drift and Hall mobilities of electrons in a fully nized gas with magnetic field has been investigated.

537.56 : 537.525.5

ON THE PROBLEM OF AMBIPOLAR DIFFUSION IN A
IAGNETIC FIELD. See Abstr. 9677

537.56

9725. LOW-FIELD MOBILITIES OF THE NEGATIVE IONS IN OXYGEN, SULFUR HEXAFLUORIDE, SULFUR DIOXIDE, AND HYDROGEN CHLORIDE. E.W.McDaniel and M.R.C.McDowell.
Phys. Rev., Vol. 114, No. 4, 1028-37 (May 15, 1959).

Measurements of the low-field mobility of the negative ions in O_2, SF_6, SO_2, and HCl are described. The results are 2.46, 0.57, 0.35, and 0.71 cm^2/(Vsec) respectively, reduced to 0° C and 760 mm Hg pressure. A quantum-mechanical theory of ionic mobility is outlined and applied to the gases investigated experimentally. Comparison of the experimental and theoretical results indicates that the oxygen ion is O_3^-, but attempts to identify the ions in the other gases are inconclusive.

537.56 : 621.385.833

9726. DISTURBANCES IN A MULTI-VELOCITY PLASMA.
J.R.Pierce and J.A.Morrison.
I.R.E. Trans Electron Devices, Vol. ED-6, No. 2, 231-6 (April, 1959).

The single-velocity treatment of a.c. disturbances in electron flow is often accurate enough even when the flow actually has an infinitely broad but peaked velocity distribution, such as a Maxwellian or a bell-shaped distribution. In seeking a better approximation, one is tempted to expand in terms of the moments of the velocity distribution and to disregard terms beyond that involving the second moment. This leads to a dispersion equation describing waves which strictly do not exist. A linearized analysis by transform methods predicts a field which oscillates in an exponentially damped manner. This is not the oscillation of a normal mode, however, for various velocity classes of the charge distribution have a.c. densities which grow with time. This indicates that the linear expression will hold over a finite interval only. A simple example which compares a multi-stream analysis with an analysis based on the charge density in phase space (the distribution function) indicates the same sort of failure of both of the linearized theories at large times. Thus, it appears that the failure is characteristic of the problem rather than of the method of solution. The method of solution is a matter of choice.

537.56 : 536.7

9727. THERMODYNAMIC FOUNDATION OF THE THEORY OF PLASMA. T.Kihara.
J. Phys. Soc. Japan, Vol. 14, No. 2, 128-33 (Feb., 1959).

The thermodynamics of irreversible processes is applied to dense plasmas in a weak magnetic field. The basic equations of "magneto-thermo-hydrodynamics" are derived, together with the various relations between transport coefficients. Extremely dilute plasmas and plasmas at the Debye—Hückel limit are discussed as particular cases.

537.56

9728. MECHANISM OF INSTABILITY OF TRANSVERSE PLASMA WAVES. B.D.Fried.
Phys. of Fluids, Vol. 2, No. 3, 337 (May-June, 1959).

Discusses the physical processes responsible for the growth of plasma instability associated with anisotropic electron velocity distributions previously considered by Weibel (Abstr. 7112 of 1959). C.G.Morgan

537.56

9729. A NEW PRINCIPLE OF EXISTENCE OF HIGH-TEMPERATURE PLASMOIDS. A.A.Vlasov.
Scientia Sinica, Vol. 8, No. 3, 266-87 (March, 1959). In Russian.

The "plasmoids" dealt with theoretically here are cylindrically symmetrical distributions of postively charged particles concentrated mainly near the axis. The disruptive effect of electrostatic, pressure, and centrifugal forces, is balanced by a Lorentz force due to the interaction of rotation of the plasmoid with an external axial magnetic field. The structure of the plasmoid is deduced from the collision-free Boltzmann equation, on the assumption that the velocity distribution is like the Maxwell distribution. An "equation of state" for the plasmoid is derived; this equation relates the temperature of the plasmoid to the particle mass, the diameter of the plasmoid, and the Larmor and plasma frequencies. Temperatures of 10^{10} to 10^{12} degrees could be attained, without large electric currents, by this method, provided the magnetic field is large and the density small. O.Penrose

537.56

9730. TRACING BACK THE KINETIC EQUATION TO THE DIFFERENTIAL FORM IN THE CASE OF COULOMB COLLISIONS. B.A.Trubnikov.
Zh. eksper. teor. Fiz., Vol. 34, No. 5, 1341-3 (1958). In Russian. English summary: PB 141052T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

By introducting "potential functions" as new unknowns in the expression for the flow of a completely ionized plasma, the integro-differential equations can be reduced to pure differential equations, the order of which can be reduced in special cases. For a "moving" Maxwell distribution all equations can be linearized. J.Hawgood

537.56

9731. INSTABILITY AND HYSTERESIS OF THE ELECTRON TEMPERATURE IN INERT GAS PLASMAS. A.V.Gurevich.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 624-6 (1959). In Russian.

The method developed in Abstr. 2446 (1959) is used to discuss analogous effects in weakly ionized plasmas; these occur if the frequency of electron collisions falls off sufficiently rapidly with an increase in their velocity. This condition is satisfied only in the heavier inert gases. As before,the stable electron temperature is calculated as a function of the applied field; values of the two critical fields are given for the Kr hysteresis loop. The effect is reduced by increasing the frequency of the applied field and disappears for $\omega > 1.5 \times 10^8$ p (p in mm Hg). The calculation is valid only for a Maxwellian electron distribution and this criterion is satisfied for a degree of ionization of $>10^{-10}$. M.G.Priestley

537.56 : 536.77

9732. THE THERMODYNAMIC PROPERTIES OF A DEGENERATE PLASMA. A.A.Vedenov.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 641-2 (1959). In Russian.

Using the diagrammatic method developed by Matsubara for the statistical Green's functions, the author calculated the interaction correction to the thermodynamic potential of a completely ionized hydrogen plasma. It was assumed that the average scattering amplitude in the Coulomb field was less than the distance R between particles, i.e. $e^2/R\bar{E} \equiv \alpha \ll 1$. The potential is expressed as an expansion in powers of α. The second term of this represents the electron exchange energy while the third represents the self-consistent interaction. M.G.Priestley

537.56 : 538.566.2

9733. ON THE PROBLEM OF THE ABSORPTION OF ELECTROMAGNETIC WAVES WITHIN THE RESONANCE RANGES OF AN INHOMOGENEOUS PLASMA. N.G.Denisov.
Zh. eksper. teor. Fiz., Vol. 34, No. 2, 528-9 (1958). In Russian. English summary: PB 141052T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The propagation of electromagnetic waves in a plasma can be described in terms of a complex refractive index. Earlier work is surveyed and the complete solution is obtained for the case of a weak inhomogeneous plasma. D.Walsh

537.56 : 530.145

COLLECTIVE MOTION IN A SYSTEM OF QUASIPARTICLES: APPLICATION TO PLASMA OSCILLATIONS. See Abstr. 9210

COSMIC RAYS

537.591 : 539.1.07

9734. ON THE STANDARD COSMIC-RAY MESON MONITOR. S.Kawasaki, I.Kondō, M.Wada and Y.Miyazaki.
J. Sci. Res. Inst. (Tokyo), Vol. 51, 107-37 (Sept., 1957).

A standard cosmic-ray meson monitor has been constructed and set up. The monitor was designed in conformity with the general specifications designated by the IUPAP Sub-Commision on Cosmic Ray Intensity Variations (SCRIV). Telescopes of wide angle total as well as hard components, vertical hard component and oblique incident hard components, were built together with the standard cubical telescopes. Continuous observations have been made with this monitor since January, 1957.

537.591 : 539.1.07 : 621.317.79 : 621.398

COSMIC-RAY INSTRUMENTATION IN THE FIRST U.S. EARTH SATELLITE. See Abstr. 8425

537.591.1 : 523.165

COMPOSITION OF PRIMARY COSMIC RADIATION. See Abstr. 9142-3

537.591.15

9735. ON THE EQUILIBRIUM FUNCTIONS FOR THE ANGULAR DISTRIBUTION OF PARTICLES IN CASCADE SHOWERS. I.P.Ivanenko.
Dokl. Akad. Nauk SSSR, Vol. 122, No. 3, 367-70 (1958). In Russian.

The angular distributions are calculated for small as well as large angles at the maximum development of the shower, taking account of multiple scattering and ionization loss, for primary particles of infinite energy. The results are valid also for finite primary energy. P.K.Kabir

537.591.15

9736. LATERAL DISTRIBUTION FUNCTION OF PHOTONS AT CASCADE SHOWER MAXIMUM. V.V.Guzhavin and I.P.Ivanenko.
Zh. eksper. teor. Fiz., Vol. 34, No. 3, 746-7 (March, 1958). In Russian. English translation in: Soviet Physics—JETP (New York), Vol. 34 (7), No. 3, 512-13 (Sept., 1958).

Knowledge of the photon lateral distribution function (LDF) is necessary for the interpretation of data on extensive air showers in cosmic ray reasurements. The authors have calculated the LDF using a moment method and compare their results graphically with those of the non-restricted calculations of Moliere, and Eyges and Fernbach, finding agreement. A.E.I.Research Laboratories

537.591.2

9737. CUT-OFF RIGIDITIES OF COSMIC-RAY PARTICLES CALCULATED FOR THE ECCENTRIC DIPOLE MODEL OF THE EARTH'S MAGNETIC FIELD. M.Kodama, I.Kondō and M.Wada.
J. Sci. Res. Inst. (Tokyo), Vol. 51, 138-57 (Sept., 1957).

Magnetic cut-off rigidities of cosmic-ray particles falling from zenith are calculated for the eccentric dipole model of the earth's magnetic field. The difference between the distances of the point of observation from the magnetic and geographic centres, actual magnetic latitude and the angle between verticals referred to the two centres are considered as the quantities for correcting the rigidities calculated for the centred dipole field. Tables of numerical results together with contour maps are presented for the points along the geographic latitudes from 70° North to 70° South in 10° intervals, with the longitude intervals of 15°. Comparisons of results of similar calculations by several workers are performed. It is shown that rigidities derived from Johnson's map (1938) are greater than the present results up to 3 BV in the middle latitudes.

537.591.3

9738. ABSORPTION CURVE OF THE PENETRATING COMPONENT OF THE COSMIC RADIATION AT A MEAN ATMOSPHERIC DEPTH OF 680 gr/cm^2. G.Piragino.
Atti Accad. Sci. Torino I, Vol. 92, No. 2, 572-5 (1957-58). In Italian.

The absorption length for the proton component is determined by subtracting from the above the μ-meson spectrum as given by other authors. R.H.W.Johnston

537.591.3 : 539.17

COSMIC-RAY NUCLEON INTERACTIONS WITH PROTONS AND CARBON ABOVE 10 GeV. See Abstr. 8572

537.591.3 : 539.12

MULTIPLE SCATTERING OF COSMIC-RAY MESONS IN LEAD. See Abstr. 8469

537.591.5

9739. DIURNAL VARIATIONS AND AN UNUSUAL HARMONIC COMPONENT OF COSMIC RAYS AT HUANCAYO, PERU. S.L.Malurkar.
Bull. Nat. Inst. Sci. India, No. 9, 68-70 (issued Oct. 18, 1957).

From the hourly cosmic ray intensity values published by Lange and Forbush, the mean diurnal variations for the three seasons, November to February, May to August and for the other four months, were calculated. The 24 hour and 12 hour components are obviously dominant. In addition, a higher component also shows reasonably large amplitude, which is possible due to a beat effect. The phase lags in the first two components change according to seasons. These are compared with phase lags of elements (meteorological and magnetic) as published in India.

537.591.5

40. 27 DAYS VARIATION OF THE INTENSITY OF COSMIC YS IN THE STRATOSPHERE.
N.Vernov, V.F.Tulinov and A.N.Charakhch'yan.
kl. Akad. Nauk SSSR, Vol. 122, No. 5, 788-91 (Oct. 11, 1958).
Russian.

The measurements were carried out with balloons, at two dif-ent geomagnetic latitudes: (a) near Moscow ($\lambda = 51^{0}$) and rmansk ($\lambda = 64^{0}$). The data (a) have been collected from July 57 to February 1958, and the data (b) from July 1957 to October 57. The results are compared with those obtained during the me period at sea level, using an ionization chamber.

G.Martelli

537.591.5

41. COSMIC-RAY RECORDS OF THE SCIENTIFIC RESEARCH STITUTE. II. Y.Miyazaki.
Sci. Res. Inst. (Tokyo), Vol. 49, 267-84 (Dec., 1955).

For previous work, see J. Sci. Res. Inst. (Tokyo), Vol. 48, -102 (June, 1954). The cosmic-ray intensities obtained in 1951 and 54 are tabulated together with the graphical representation of their onthly average, daily variation and 27-day recurrence tendency. ndency.

537.591.5

42. A STATISTICAL INVESTIGATION FOR THE ATMO-HERIC TEMPERATURE EFFECT ON COSMIC-RAY INTENSITY.
Wada and S.Kudo.
Sci. Res. Inst. (Tokyo), Vol. 50, 1-9 (March, 1956).

By taking the partial temperature coefficient into account, the nospheric temperature effect on cosmic-ray intensity at sea vel was investigated statistically. The method of analysis is such at some ambiguous points noticed by Olbert and by Trefall can avoided. The obtained coefficient corresponding to the tempera-e variation in the upper atmosphere indicates the existence of sitive temperature effect due to the $\pi - \mu$ decay phenomenon.

537.591.5

43. COMPARISON OF COSMIC-RAY INTENSITY VARIATIONS SERVED AT DIFFERENT ALTITUDES. Y.Miyazaki.
Sci. Res. Inst. (Tokyo), Vol. 51, 97-106 (Sept., 1957).

Simultaneous registrations of cosmic-ray meson component re made at sea level and at mountain altitude of almost the same omagnetic latitude and longitude. The time variation of the com-ratively low-energy side of the primary cosmic radiation could be rived by comparison of the intensity variations observed at dif-ent altitudes.

MAGNETISM

MAGNETIC RESONANCES

538.07

44. MAGNETIC FLUXMETER PROBES. B. Ancker-Johnson.
v. sci. Instrum., Vol. 30, No. 6, 492-4 (June, 1959).

Constructional details of transmission line paramagnetic reson-e probes for transverse and axial fields are given. The probe for nsverse fields is less than 0.05 in. thick.

A.J.Manuel

538.08 : 621.317.444

45. DYNAMIC-CONDENSER MAGNETIC FLUXMETER.
3.Burson, D.W.Martin and L.C.Schmid.
v. sci. Instrum., Vol. 30, No. 7, 513-21 (July, 1959).

This instrument was designed to measure and control the flux nsity between the poles of an iron-core electromagnet used in con-ction with a beta-ray spectrometer. A sensing coil, rotating at 00 r.p.m., generates 0.115 V (r.m.s.) per gauss. A comparison nal, against which the e.m.f. of the coil is bucked, is generated ctrostatically by a dynamic condenser. Its rotor plates are shaped produce a sinusoidal wave form. The amplitude of the comparison nal is determined by a d.c. voltage applied between two stator tions which are juxtaposed on opposite sides of the rotor shaft. is voltage thus provides a measure of the field strength. An balanced condition results in the appearance of a 30 c/s error nal at the stator sections (which are isolated with respect to a.c.). er amplification and synchronous rectification, this signal indicat-the degree and phase of the imbalance. The motor speed is main-ned constant by a precision 60 c/s tuning fork. The stability of the fluxmeter is of the order of one part in 2500, as determined by the reproducibility of the positions of internal-conversion-electron lines from Bi^{207} and Cs^{137} sources.

538.08 : 621.316.73

9746. FLUX CONCENTRATOR FOR HIGH-INTENSITY PULSED MAGNETIC FIELDS. Y.B.Kim and E.D.Platner.
Rev. sci. Instrum., Vol. 30, No. 7, 524-33 (July, 1959).

Use of multiturn coil structure in the production of several hundred kilogauss pulsed fields is discussed with specific emphasis on coil life. The magnetic force that shortens the coil life is reduced by introducing a flux concentration device. Into the multiturn coil is inserted a rigid, slotted metal slug that generates induction current in such a way as to shift the magnetic flux from the multiturn to the central vacuum region and serves as a flux concentrator. Electromagnetically and mechanically this scheme is a convenient synthesis of the multiturn and single turn coils. The advantage of this scheme is most apparent for tape-wound coil structures, and a quantitative analysis of the flux pattern relevant to this coil system is given. An analogue computer is employed in solving the time dependence of the field. The results are documented by experimental tests carried out with a 3000 μF, 4 kV capacitor bank.

538.08

9747. VERSATILE AND SENSITIVE VIBRATING-SAMPLE MAGNETOMETER. S.Foner.
Rev. sci. Instrum., Vol. 30, No. 7, 548-57 (July, 1959).

A vibrating-sample magnetometer, which measures the magnetic moment of a sample when it is vibrated perpendicularly to a uniform magnetizing field, is described. With this instrument, changes as small as 10^{-5} to 10^{-6} e.m.u. have been detected, and a stability of one part in 10^{4} has been attained. In addition to permitting convenient measurements in the usual laboratory electromagnet, this instrument eliminates or minimizes many sources of error found in other methods. It is simple, inexpensive, and versatile, yet permits precision magnetic moment measurements to be made in a uniform magnetizing field as a function of temperature, magnetizing field, and crystallographic orientation. The mechanical design and detailed operating characteristics are presented. Applications and limitations of the method are outlined.

538.08

9748. HIGH-PRECISION MEASUREMENT OF THE AVERAGE VALUE OF A MAGNETIC FIELD OVER AN EXTENDED PATH IN SPACE. C.Sherman.
Rev. sci. Instrum., Vol. 30, No. 7, 568-75 (July, 1959).

A nuclear magnetic resonance experiment which may be used to measure with high precision the average value of a magnetic field over an extended path in space is described. The nuclei, contained in a flowing liquid, are excited at one point and detected at another downstream from the point of excitation. Under proper conditions the average value of the magnetic field along the flow path between points of excitation and detection may be obtained therefrom. Some experimental criteria which must be met in order that this average be correctly obtained are discussed. The results of such an experiment are presented. Although the accuracy of the measurement may be somewhat less than this, line widths of 1 part in 10^{7} have been obtained.

538.1

9749. THE STABILITY OF ROTATING FERROMAGNETIC BODIES SUSPENDED IN A MAGNETIC FIELD.
V.V.Vladimirskii and S.M.Kalebin.
Pribory i Tekh. Eksper., 1959, No. 2, 41-5 (March-April). In Russian.

Calculates the forces acting on a small magnetically suspended iron sphere and their dependence on the angular velocity of rotation of the sphere. Next calculates the trajectory of the centre of gravity of the sphere and shows that its position is unstable. Supplementary damping forces are shown to be necessary in a magnetic suspension and the conditions to be satisfied by these forces are laid down. The mathematical results are applied qualitatively to suspended bodies of arbitrary shape. The results provide an explanation of the structural properties of magnetic suspensions described in the literature.

D.E.Brown

538.1 : 537.534 : 539.18 : 621.318.23

9750. PERMANENT MAGNET FOR ATOMIC BEAM FOCUSING.
R.L.Christensen and D.R.Hamilton.
Rev. sci. Instrum., Vol. 30, No. 5, 356-8 (May, 1959).

A compact six-pole permanent magnet useful for focusing of atomic beams is described, together with the equations of motion of atoms in its field as used in its design. The method of construction, magnetization, and measurement of its field are discussed.

538.1

9751. SOME REMARKS ON THE BLOCH'S THEORY OF SPIN-WAVES. Z.Semadeni.
Acta phys. Polon., Vol. 15, No. 6, 423-8 (1956).

Discusses the validity of certain approximations in Bloch's analysis. It is shown that, contrary to Bloch's conclusion, ferromagnetism is possible for a one-dimensional lattice. The derivation of the $T^{3/2}$ law for the spontaneous magnetization in three-dimensional lattices is also criticized. D.M.Edwards

538.1

9752. SPIN WAVES FREQUENCY SPECTRUM FOR VARIOUS ORDERS OF FERRIMAGNETIC TRANSLATION LATTICES. H.Cofta.
Bull. Acad. Polon. Sci. Ser. Sci. math. astron. phys., Vol. 6, No. 8, 519-22 (1958).

The semiclassical theory of spin waves is used to discuss the case of ferrimagnetism with three different spins. D.M.Edwards

538.1

9753. EXCHANGE ENERGY OF AN ELECTRON GAS IN A STRONG MAGNETIC FIELD. G.Dresselhaus.
Phys. Rev., Vol. 114, No. 3, 736-8 (May 1, 1959).

The magnetic field variation of the exchange energy of a free-electron gas is calculated by deriving the form of the "Fermi hole" around each electron. The wave-functions which are used exactly diagonalize the kinetic energy. The resulting charge distribution is integrated to find the exchange energy. The exchange energy has the same periodicity in the reciprocal magnetic field which is displayed by the kinetic energy. Hence, it is concluded that the de Haas—van Alphen effect is unchanged by the field variation of the exchange energy except for a possible shift in the phase of the oscillations.

538.1

9754. REMARK ON THE PAULI PARAMAGNETISM OF AN ELECTRON GAS. J.Peretti.
C.R. Acad. Sci. (Paris), Vol. 248, No. 9, 1303-4 (March 2, 1959). In French.

It is shown that the susceptibility cannot be uniquely defined if the electrons are considered as interacting only through Coulomb forces. The existence of the very weak magnetic dipole interactions is essential for the definition of a single chemical potential for electrons of both spins. D.M.Edwards

538.1

9755. ON THE NON-ORTHOGONALITY DIFFICULTY IN FERROMAGNETISM. F.Takano.
J. Phys. Soc. Japan, Vol. 14, No. 3, 348-60 (March, 1959).

In a many-electron system, one is faced with difficulties when one-electron wave-functions are not orthogonal to each other. For example, the inner product (Φ,Φ) (Φ is a Slater determinant made from these non-orthogonal wave-functions) loses its meaning as the number of electrons becomes large. This difficulty is avoided by using the expansion coefficients instead of the inner products, in order to define the matrix elements of operators. Applying this method to a magnetic problem, in which there are some doubts about the validity of the Heisenberg model

$$\mathcal{H} = -2 \sum_{i>j} J_{i,j} S_i \cdot S_j ,$$

the energy of the ground state and the energy spectrum of spin waves can be derived. The results are written as

$$W_0 = \sum_{i=1}^{N} f_{i,j} + \tfrac{1}{2} \sum_{i} \sum_{j} (g_{ij,ij} - g_{ij,ji}),$$

and

$$\epsilon(K) = \sum_{j=1}^{N} \alpha_K(j) \beta_K(j).$$

Some mathematical difficulties which occur in the case of the state in which more than two spins are reversed are discussed.

538.2

9756. THE MAGNETIC CRYSTALLOGRAPHIC GROUPS AND THEIR PROPERTIES. Y.Le Corre.
J. Phys. Radium, Vol. 19, No. 10, 750-64 (Oct., 1958). In French.

The 122 crystal classes obtained when an anti-symmetry operation (e.g. reversal of magnetic moment) is included in the permitted symmetry operations, are enumerated with an indication of whether they can be diamagnetic or paramagnetic, ferromagnetic, antiferromagnetic, or piezomagnetic. The possibility of influencing, by physical conditions, the class of domains formed on cooling a crystal through its Curie or Néel point is suggested. The symmetry of several well-known magnetic structures is discussed. A.J.Manuel

538.2 : 539.2

TYPES OF MAGNETICALLY ORDERED CONFIGURATIONS ON SIMPLE LATTICES. See Abstr. 8796

538.2 : 548.736.4

MAGNETIC PROPERTIES OF THE $Li_xCo_{(1-x)}O$ SYSTEM. See Abstr. 9039

538.2 : 539.19

MAGNETIC STUDY OF THE FROZEN PRODUCTS FROM THE NITROGEN MICROWAVE DISCHARGE. See Abstr. 8699

538.2 : 539.19

9757. MAGNETIC PROPERTIES OF WATER MOLECULE. T.P.Das and T.Ghose.
J. chem. Phys., Vol. 31, No. 1, 42-52 (July, 1959).

The mass susceptibility χ and proton magnetic shielding factor σ for H_2O molecule are calculated using a localized electron pair LCAO MO wave-function. The paramagnetic part of the susceptibility and a portion of the paramagnetic part of σ are calculated by a variational method used earlier for the H_2 molecule. The relation of the present variational method to the methods employed by McGarvey (Abstr. 380 of 1958) and by Stephen (Abstr. 379 of 1958) is discussed in some detail. The calculated value of χ is found to be -0.687×10^{-6} in very good agreement with the experimental value of -0.699×10^{-6}. (In an earlier report [Bulletin of the American Phys. Soc., Ser. II, Vol. 3, 372 (1958) the authors stated the calculated value of χ erroneously as -0.692×10^{-6}). The calculated value of σ is, however, found to be only -0.85×10^{-5} in rather poor agreement with the experimental value of -2.97×10^{-5}. The causes for this poor agreement are analysed, and it is concluded that the main reasons are (1) use of a rather large ionic character (66%) for the OH bond obtained from a curve of electronegativity difference v. ionic character and (2) use of undistorted H-atom orbitals in the LCAO MO function. It is suggested that the calculated value of σ would improve in the right direction if the effective charge for the H-atom orbital were taken as greater than unity. The value of σ is recalculated with Ellison and Shull's "approximate treatment" wave-function and found to be -1.31×10^{-5}. The disagreement with experiment in this case is ascribed to cause (2). Arguments are presented to show that more accurate values of σ for protons in a molecule can be obtained if in the Hamiltonian for the electrons the origin for the first-order perturbation term due to the magnetic field is taken at the centroid of the electronic charge rather than at any other point.

538.2

9758. ON THE VARIATION OF THE DIAMAGNETIC SUSCEPTIBILITY OF WATER WITH TEMPERATURE IN THE THOMAS—FERMI MODEL. T.Tietz.
J. chem. Phys., Vol. 31, No. 1, 274-5 (July, 1959).

An expression is derived for the diamagnetic susceptibility per gram of water. This is

$$\chi_t = -[(9.43 \times 10^{-6})/Z^{2/3}W] \cdot [1 - 3.01(\alpha_t/Z) + 3.92(\alpha_t^2/Z^2)](Z - \alpha_t)$$

where α_t is the number of free electrons per molecule, obtained using the Thomas—Fermi function. The results obtained for the relative susceptibility are compared with the experimental results of Calbrera and Fahlenbrach [Z. Phys., Vol. 82, 759 (1933)] and of Mathur (Abstr. 226 of 1932). Good agreement with the results of Calbrera and Fahlenbrach is obtained over the temperature range 0°C to 100°C. S.A.Ahern

538.2

59. THE MAGNETIC SUSCEPTIBILITY OF METALS. F.J.Blatt. Phys. Chem. Solids, Vol. 6, No. 2-3, 301-3 (Aug., 1958).

Suggests that the effects of electron—lattice interactions shown Jones (Abstr. 9143 of 1957) to be important for the specific ats of metals, whose Fermi surface is close to a zone boundary, y also contribute to the diamagnetic susceptibility of the alkali tals. E.P.Wohlfarth

538.2 : 539.219

30. SIMULTANEOUS DETERMINATION OF PARTICLE SIZE D MAGNETIZATION IN THE ANGSTRÖM RANGE BY ASUREMENT OF SUPERPARAMAGNETISM. A.Knappwost. turwissenschaften, Vol. 46, No. 2, 65-6 (1959). In German.

The χ, I/H curve for Co precipitates in a dilute Cu—Co alloy is ed to estimate the particle size as 25.3 A, and the magnetization as 9 gauss. E.P.Wohlfarth

538.2 : 537.311.33

61. MAGNETIC SUSCEPTIBILITY OF SOLIDS. J.A.Krumhansl. appl. Phys., Vol. 30, No. 8, 1183-6 (Aug., 1959).

The magnetic susceptibility of semiconductors depends on ctronic properties of the lattice, on the motion of free carriers d on the presence of impurity states. Critical points in the work Ge and Si are reviewed relative to demands they place on theor-cal interpretations. Anomalies in the susceptibility of high-rity specimens, various aspects of valence band carrier suscept-lity, and the susceptibility of acceptor states are not yet explained tisfactorily.

538.2

62. MAGNETIC PROPERTIES OF SOME IRIDIUM COMPLEXES. Norman and J.C.Morrow III. chem. Phys., Vol. 31, No. 2, 455-9 (Aug., 1959).

The magnetic susceptibilities of a series of iridium complexes ve been measured over a temperature range from 78°K to room mperature. K_2IrCl_6, $(NH_4)_2IrCl_6$, $(NH_4)_2IrBr_6$, and $(CH_3NH_3)_2IrCl_6$ llow the Curie—Weiss relationship approximately. The suscept-ilities of $(C_5H_6N)_2IrCl_6$ and $(\Phi_4As)_2IrCl_6$ do not yield straight line χ_m v. T°K plots. $Ir(C_5H_5N)_2Cl_4$ was found to be diamagnetic.

538.2

63. THE INTERACTION BETWEEN CONDUCTIVITY ECTRONS IN FERROMAGNETICS. I.Akhiezer and I.Ya.Pomeranchuk. . eksper. teor. Fiz., Vol. 36, No. 3, 859-62 (1959). In Russian.

It is shown that there is an additional attraction between con-ctivity electrons, which is due to the exchange of the spin waves.

538.2

64. ON THE NUMBER OF 3d ELECTRONS IN IRON. .Kittel and W.Marshall. Phys. Chem. Solids, Vol. 6, No. 1, 99 (July, 1958).

Points out that the Weiss—De Marco phenomenon appears to inconsistent with the positive values of g − 2 and 2 − g', although e effect of the admixture of 3d states in the conduction band may verse this conclusion. E.P.Wohlfarth

538.2 : 539.219

MAGNETIC PROPERTIES OF IRON-RICH IRON—ALUMINIUM LLOYS. See Abstr. 8897

538.2

65. MAGNETIC PROPERTIES OF $NiTiO_3$—Fe_2O_3 SOLID LUTION SERIES. Y.Ishikawa. Phys. Soc. Japan, Vol. 12, No. 10, 1165 (Oct., 1957).

Magnetic measurements are reported for compounds of compo-tion $xNiTiO_3.(1-x)Fe_2O_3$. It was found that solid solutions are rmed for all values of x and that they are ferromagnetic in the nge $0.9 \geq x > 0.6$. The compound with the greatest saturation tensity corresponds to $x = 0.7$. The Curie—Weiss constants and e transformation temperatures are related linearly to x over the ole composition range. The magnetic behaviour of the compounds generally similar to those represented by $xFeTiO_3.(1-x)Fe_2O_3$ and e minor differences are ascribed to the ease of electron transfer tween iron ions in different valency states in the case of the tter compounds. R.Parker

538.2

9766. INVESTIGATION OF THE MAGNETIC PROPERTIES OF CERTAIN Cu—Ni—Fe ALLOYS. D.Balli and A.Glodyanu. Rev. de Physique (Bucarest), Vol. 3, No. 2, 129-39 (1958). In Russian.

Reports studies of the dependences of the coercive force, the remanence and the Curie point on the duration of annealing at 550°C of Cu—Ni—Fe alloys with 8-27 atomic % of Fe, 37-38% of Ni, and 35-55% of Cu. It is found that the remanence increases with the duration of annealing until values of 395-942 G are reached; further annealing either does not alter the remanence or decreases it. The coercive force and the Curie point also increased with the duration of annealing. After annealing for 40 hr or longer the Curie point remained constant. A.Tybulewicz

538.2

9767. SINGLE CRYSTAL ANISOTROPY AND MAGNETOSTRICTION CONSTANTS OF SEVERAL FERROMAGNETIC MATERIALS INCLUDING ALLOYS OF NiFe, SiFe, AlFe, CoNi, AND CoFe. R.C.Hall. J. appl. Phys., Vol. 30, No. 6, 816-19 (June, 1959).

The anisotropy and magnetostriction of single crystals of several ferromagnetic materials have been determined experimentally. The materials include the metals iron and nickel, binary alloys of nickel iron, silicon iron, aluminium iron, cobalt nickel, and cobalt iron, ternary alloys of molybdenum nickel iron, nickel cobalt iron, and molybdenum aluminium iron, and magnetite. The effect of the order-disorder reaction on these properties was measured for several of the alloys. The data for the nickel iron and silicon iron systems agree well with recently published values. Ordering generally raises the magnetostriction and lowers the anisotropy of the aluminium iron alloys near the Fe_3Al composition. The first anisotropy constant, K_1, for the cobalt nickel system as derived from torque curves is similar to old data derived from magnetization curves. However, K_1 for cobalt iron (30, 35, and 45% cobalt) appears to be considerably larger than previously reported. In general, the addition of cobalt to nickel and to iron changes the magnetostriction constants (λ_{100} and λ_{111}) towards large positive values. Thus, λ_{100} increases to 100×10^{-6} for 50% cobalt nickel and to 130×10^{-6} for 45% cobalt iron; λ_{111} increases to 30×10^{-6} for 45% cobalt iron but remains approximately constant for the cobalt nickel alloys.

538.2

9768. MAGNETIC ANISOTROPY MEASUREMENTS OF NiO SINGLE CRYSTAL. H.Kondoh, E.Uchida, Y.Nakazumi and T.Nagamiya. J. Phys. Soc. Japan, Vol. 13, No. 6, 579-86 (June, 1958).

The magnetic anisotropy of a NiO single crystal grown by the Verneuil method was measured using a torque balance. An X-ray study showed that the crystal, despite its outward appearance of a single crystal, was composed of small rhombohedral domains twinned through {100} planes. By applying a pressure along one of the [111] axes of the crystal during annealing from above the Néel temperature, the twin structure was partly removed. Torque measurements in a homogeneous magnetic field and their analysis showed that, in pressure-annealed crystals, domains with trigonal axis pointing along the direction of the pressure dominate, but antiferromagnetic domains in each crystallite are distributed at random. The spin axis was found to be in the plane perpendicular to the trigonal axis within ±16°.

538.2

9769. THE DETERMINATION OF SPONTANEOUS MAGNETIZATION IN THE REGION OF THE CURIE POINT. J.Pačes. Czech. J. Phys., Vol. 8, No. 5, 563-73 (1958). In Russian.

The method described is analogous to that of Weiss and Forrer (Abstr. 1463 of 1926) using instead of the magneto-caloric effect, the change in magnetoresistance, which depends on the magnetization in a similar way. This procedure is more complicated, since the effect of processes in technical magnetization must be taken into account. It is shown that with inhomogeneous materials this method gives average values as long as a particular function is satisfactory and linear extrapolation is possible to the point where the negative magnetization change in resistance is zero. The temperature dependence for electrolytic Ni and two Si—Ni alloys was calculated and the agreement was better for alloys which homogenize very badly. S.C.Dunn

538.2

9770. METHOD OF MEASURING THE DISTRIBUTION OF THE EASY AXES OF UNIAXIAL FERROMAGNETICS.
E.H.Frei, S.Shtrikman and D.Treves.
J. appl. Phys., Vol. 30, No. 3, 443 (March, 1959).

The distribution, having azimuthal symmetry, may be determined for non-interacting single domains by measuring the parallel or perpendicular components of the remanent magnetization, between which a relationship is established. E.P.Wohlfarth

538.2

9771. MAGNETIC PROPERTIES OF ROCKS.
H.Narain and V.Bhaskara Rao.
J. Roy. Soc. New S. Wales, Vol. 91, Pt 1, 36-54 (1957).

A critical review of previous research in this field is made. The phenomenon of hysteresis in rocks, and the variation of susceptibility with magnetizing field and the magnetite content of rocks, were studied. A modified method of obtaining the hysteresis loops on the cathode-ray oscillograph was developed. Severe scatter in the relationship between the specific susceptibility and the normative, modal and volume magnetite contents of the rocks was observed. However, an empirical linear relationship between the specific susceptibility at a field of 8.8 Oe and the normative magnetite content was established. The results, though quantitatively difficult to analyse and interpret, indicate qualitatively the ferromagnetic behaviour of rocks. This is primarily due to the presence of magnetite, though other magnetic minerals also contribute to the phenomenon.

538.2 : 539.234

9772. THE MAGNETIZATION OF VERY THIN IRON FILMS.
H.Hoffmann and C.Schwink.
Naturwissenschaften, Vol. 46, No. 6, 198-9 (1959). In German.

Iron films of thickness 60-150 A were evaporated, and the magnetization, measured after evaporation but with the specimen still in situ, was found to depend critically on the presence of gaseous impurities. E.P.Wohlfarth

538.2

9773. MAGNETIZATION AND COERCIVE FORCE OF NICKEL–ZINC FERRITES ESPECIALLY WITH ADDED IMPURITIES.
W.Holzmüller and T.Kampf.
Nachrichtentechnik, Vol. 9, No. 1, 44-6 (Jan., 1959). In German.

The changes in coercivity with sintering temperature, between 1100°C and 1500°C, have been investigated for pure nickel–zinc ferrite and with WO_3, Cr_2O_3, ThO_2, and BeO as impurities at volume concentrations from 3% to 15%. A.J.Manuel

538.2

9774. ON MAKING COERCIVE FORCE CONCEPTS MORE PRECISE. A.I.Parfent'ev and V.K.Kushnarev.
Zh. tekh. Fiz., Vol. 27, No. 10, 2388-91 (Oct., 1957). In Russian.
English translation in: Soviet Physics — Technical Physics (New York), Vol. 2, No. 10, 2222-5 (Oct., 1957).

The authors discuss various definitions of coercive force and report measurements of the fields required to reduce to zero (i) the induction, (ii) magnetization and (iii) remanence in powders of $\gamma\text{-Fe}_2\text{O}_3$ and cobalt-containing iron oxide. The values of these fields were (i) 58.5, (ii) 84.5 and (iii) 130.0 Oe for $\gamma\text{-Fe}_2\text{O}_3$ and (i) 130.0, (ii) 175.0 and (iii) 227.0 Oe for cobalt-containing iron oxide. E.P.Wohlfarth

538.2

9775. EDDY CURRENT LOSSES IN 65/35 NICKEL–IRON.
E.W.Lee, A.G.H.Troughton and D.R.Callaby.
Proc. Phys. Soc., Vol. 73, Pt 1, 133-6 (Jan., 1959).

Measurements of the eddy current losses show that the ratio of the actual eddy current loss to that calculated assuming uniform permeability can be as great as 64 : 1. From this ratio the average number of domain walls can be calculated and the variation of this number with thickness has been determined. A.E.De Barr

538.2 : 539.215.2

SYNTHESIS OF A (110) [001] TYPE TORQUE CURVE IN SILICON IRON. See Abstr. 8876

538.2

9776. EXPLANATION OF THE TRANSVERSE ELECTRICAL THERMOMAGNETIC PHENOMENON IN FERROMAGNETICS BY MEANS OF THE RESULTS OF THE (s–d) EXCHANGE MODEL OF A METAL. N.P.Patrakhin.
Fiz. Metallov i Metallovedenie, Vol. 6, No. 1, 15-22 (1958).
In Russian.

Mathematical theory of the Nernst effect. A.F.Brown

538.2

9777. THERMOMAGNETIC TREATMENT AND THE PROCESSES OF ORDERING. II. THE INFLUENCE OF THERMOMAGNETIC TREATMENT ON STRUCTURAL CHANGES IN ORDERING ALLOYS.
A.A.Glazer and Ya.S.Shur.
Fiz. Metallov i Metallovedenie, Vol. 6, No. 1, 52-9 (1958).
In Russian.

For Pt I, see ibid.Vol. 3, 568 (1956). The alloys studied were two of the Permalloy type and a Perminvar (Ni, 34; Fe, 34; Co, 29; Mo, 3%). Specimens were brought into ordered condition by prolonged heating at temperatures $< T_c$ or into disordered condition by quenching from temperatures $> T_c$. The thermomagnetic treatment (t.m.t.) consisted of heating for various times at temperatures $\sim 450^\circ$C in magnetic fields of 50 or 200 Oe. Measurements were made of magnetostriction (λ_s) and coercive force (H_c) as function of time of t.m.t. Processes leading to formation of a magnetic texture (as measured by λ_s) proceed slower in ordered than in disordered alloys. From this and from the kinetics of change of H_c with t.m.t. it is concluded that t.m.t. brings a ferromagnetic into a condition which may be identified with the "oriented superstructure" predicted theoretically by Néel (Abstr. 7548 of 1954) and others.
A.F.Brown

538.2

9778. MAGNETIC DOMAINS IN $\alpha\text{-Fe}_2\text{O}_3$.
H.J.Williams, R.C.Sherwood and J.P.Remeika.
J. appl. Phys., Vol. 29, No. 12, 1772-3 (Dec., 1958).

Reports results of domain pattern observations on a thin transparent crystal using the Faraday effect. The domain structure was found to change by the application of low fields, and is believed to be a bulk property of the crystal. The results are compatible with those of Abstr. 9753 (1957). E.P.Wohlfarth

538.2

9779. FERROMAGNETIC DOMAIN SIZES IN POLYCRYSTALLINE SILICON-IRON. D.Bloor and D.H.Martin.
Proc. Phys. Soc., Vol. 73, Pt. 4, 694-5 (April, 1959).

The mean domain widths D in well annealed 2.79% Si–Fe were measured as a function of the mean grain lengths L(in the [100] direction), which vary between 0.01 and 0.10 cm; a theoretical relation $D \propto L^{3/4}$ was found to be fairly well established. E.P.Wohlfarth

538.2

9780. SURFACE STRUCTURE OF WEISS DOMAINS ON VERY SLIGHTLY INCLINED (100) PLANES. L.Špaček.
Exper. Tech. der Phys., Vol. 7, No. 2, 85-90 (1959). In German.

Describes the geometrical details of the "fir tree" pattern on a (100) plane of a Si-Fe crystal by minimizing the estimated sum of the magnetostatic, magnetoelastic and Bloch wall energies.
E.P.Wohlfarth

538.2

9781. ON THE INFLUENCE OF MAGNETOSTRICTION ON THE ENERGY AND THICKNESS OF BLOCH WALLS. G.Rieder.
Z. Naturforsch. Vol. 14a, No. 1, 96-7 (Jan., 1959). In German.

A short note giving the results of the effect of including magnetostrictive terms in the calculations of wall thickness and energy. A.E.De Barr

538.2

9782. THE BEHAVIOUR OF ISOLATED STABILIZED BLOCH WALLS IN MAGNETIZATION CYCLES. A.v.Kienlin.
Z. angew. Phys., Vol. 11, No. 3, 118-20 (March, 1959). In German.

Discontinuous changes in the areas of the hysteresis curves, for two ring-shaped specimens of magnetite containing cobalt, have been observed using a slowly increasing small amplitude, alternating magnetic field. The specimens had been magnetically annealed, demagnetized and re-annealed at a temperature below the Curie point. The form of the hysteresis curves is attributed to irreversible jumps of the relatively few stabilized Bloch walls produced by the heat treatment. A.J.Manuel

538.2

83. THE MAGNETIC STRUCTURE OF Fe_3Al.
Nathans, M.T.Pigott and C.G.Shull.
Phys. Chem. Solids, Vol. 6, No. 1, 38-42 (July, 1958).

A polarized-neutron-beam spectrometer has been used to termine the room-temperature magnetic structure of ordered $_3$Al. The results show that the aluminium atoms possess no mag- tic moment and that the iron moments differ for the two sub- ttice sites. On one sublattice, where the iron atoms are surrounded both iron and aluminium nearest neighbours, the average moment r atom is found to be 1.46 ± 0.1 μ_B. On the other sublattice, where e iron atoms have only iron atoms as nearest neighbours, the erage moment per atom is found to be 2.14 ± 0.1 μ_B. The data ken on high-order magnetic reflections also permitted a compari- n of the magnetic form factors for each of the different sites with at of metallic iron. No difference was observed to within the ±2% curacy of the measurements on the form factor.

538.2

84. THE EFFECT OF TENSION ON THE MAGNETOSTRICTION
F IRON SINGLE CRYSTALS. H.Takaki and J.Hayashi.
Phys. Soc. Japan, Vol. 13, No. 7, 703-9 (July, 1958).

The magnetostriction of iron single crystals was measured der various tensions at room temperature by means of the strain uge technique. Two magnetostriction constants λ_{100} and λ_{111} were und to be independent of tension. Formerly one of the authors served a tension-dependent magnetostriction constant by using a echano-optical lever, which was found to be due to overlooking the ct that the long rod specimen is not uniformly magnetized over the ole length on account of its demagnetizing field. It was found that e magnetostriction of the rod specimen must be measured only in s uniformly magnetized portion. The mean values of magneto- riction constants were: $\lambda_{100} = 19.2 \times 10^{-6}$, $\lambda_{111} = -22.6 \times 10^{-6}$.

538.2 : 534.22

85. DEPENDENCE OF SOUND VELOCITY AND ATTENUATION
N MAGNETIZATION DIRECTION IN NICKEL AT HIGH FIELDS.
A.Alers, J.R.Neighbours and H.Sato.
Phys. Chem. Solids, Vol. 9, No. 1, 21-7 (Jan., 1959).

The velocity and attenuation of 10 Mc/s sound waves in a nickel ngle crystal have been measured as a function of magnetic field ientation and intensity at room temperature and at 77°K. Changes the velocity of transverse waves of the order of 0.1% were observ- when the crystal was rotated about a crystallographic axis in a agnetic field high enough to allow saturation of the elastic con- ants. Attenuation changes were also observed, but showed a dif- rent angular dependence than the velocity changes. The measure- ents can be explained by a phenomenological theory based on mag- to-elastic coupling. Using this theory, it was possible to estimate e magnetostriction constants at 77°K. The resulting value for $_{00}$ ($\lambda_{100} = -30 \times 10^{-6}$) supports previous measurements which show at it goes through a minimum near 173°K.

538.2

86. THE PHYSICAL PROPERTIES OF THE CHROMIUM–
ERMANIUM ALLOYS. I. I.G.Fakidov and N.P.Grazhdankina.
iz. Metallov i Metallovedenie, Vol. 6, No. 1, 67-73 (1958).
Russian.

A series of Cr–Ge alloys with 50-95 atomic % Ge were found be ferromagnetic with Curie temperatures ~ 98°K. Measurements e recorded of electrical resistivity, its temperature coefficient d magnetoresistance for these alloys at temperatures –200 to 00° C and in magnetic fields up to 14 kOe. From these results d from metallographic investigation they conclude that the only rromagnetic phase is $CrGe_3$. A.F.Brown

538.2

87. SOME REGULARITIES IN THE MAGNETIC PROPERTIES
F MANGANESE–BISMUTH PERMANENT MAGNETS. A.B.Al'tman.
iz. Metallov i Metallovedenie, Vol. 6, No. 1, 46-51 (1958).
Russian.

A simplified method of making Mn–Bi permanent magnets from wders is described. Maximum magnetic energy obtained in them 150 000 erg/cm^3. The effects of variations in the conditions of mpacting, etc., are systematically studied. The irreversible fall magnetic properties of these magnets produced by cooling below om temperature still limits their usefulness but may yet be elim- ated by chemical addition to the Mn–Bi compacts. 13 references. A.F.Brown

538.2

9788. SOME PROPERTIES OF MIXED GARNETS OF
GADOLINIUM-ERBIUM AND GADOLINIUM-YTTRIUM.
G.Villers, J.Loriers and C.Claudel.
C.R. Acad. Sci. (Paris), Vol. 247, No. 8, 710-13 (Aug. 25, 1958).
In French.

Reports measurements of the lattice constants, Curie points, and compensation temperatures. Graphs are given showing these quantities as functions of composition. The variation of the compensation temperatures is interpreted theoretically by extending to mixed garnets the magnetization mechanism proposed by Neel (Abstr. 9381 of 1954). D.M.Edwards

538.2

9789. MAGNETIC PROPERTIES OF NICKEL AND COBALT
FERRITE—CHROMITE SERIES. S.Miyahara and T.Tsushima.
J. Phys. Soc. Japan, Vol. 13, No. 7, 758 (July, 1958).

The results of an experimental study of the magnetic properties of the series $NiFe_{2-t}Cr_tO_4$ and $CoFe_{2-t}Cr_tO_4$, in which t is varied from 0 to 2, are reported. Magnetization measurements have been made over the temperature range from the liquid nitrogen boiling point to 900°K, and extrapolated to 0°K. For the nickel series it is assumed that chromium ions always occupy octahedral sites and that nickel ions preferentially occupy octahedral sites. The variation of magnetization at 0°K is then represented by $(2 - 2t)\beta$ for $t < 1$ in good agreement with experiment; on the same basis for $1 < t < 2$ the magnetization is represented by $(4 - 4t)\beta$ which differs significantly from the experimental results. Interpretation of the data on the cobalt series is not attempted because of insufficient information about the distribution of magnetic ions. S.A.Ahern

538.2

9790. TEMPERATURE DEPENDENCE OF THE MAGNETO-CRYSTALLINE ANISOTROPY OF NICKEL FERRITE. G.Elbinger.
Naturwissenschaften, Vol. 46, No. 4, 140 (1959). In German.

Reports results of torque curve measurements for a single crystal of $Ni_{0.95}Fe_{2.05}O_4$ between 88° and 723°K. The value of K_1 varies between –10.3 and -0.4×10^4 erg cm^{-3} over this range. E.P.Wohlfarth

538.2

9791. GEOMETRICAL ANISOTROPY OF MAGNETIC
MATERIALS IN WAVE GUIDES AND CAVITIES. L.A.Steinert.
J. appl. Phys., Vol. 30, No. 7, 1109 (July, 1959).

A general derivation of the effective susceptibilities of ellipsoidal isotropic ferrite samples in uniform magnetic fields is given in matrix notation. The general formulae are then simplified for specimens shaped as spheres, long cylinders and thin circular disks. R.C.Kell

538.2

9792. THE MAGNETIC SUSCEPTIBILITY OF A UNIAXIAL
ANTIFERROMAGNETIC SUBSTANCE.
M.I.Kaganov and V.M.Tsukernik.
Zh. eksper. teor. Fiz., Vol. 34, No. 2, 524-5 (1958). In Russian.
English summary: PB 141052T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The complex transverse susceptibility is calculated taking account of relaxation processes on the basis of the Landau–Lifshitz equation. E.P.Wohlfarth

538.2

9793. MAGNETIC ANISOTROPY OF SINGLE CRYSTALS [OF
ANHYDROUS] $CuSO_4$ IN THE ANTIFERROMAGNETIC STATE.
N.M.Kreines.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1391-7 (1958). In Russian.

The anisotropy was measured between 1.5° and 300°K. The transition to the antiferromagnetic state has been found to be accompanied by an anomalous growth of $\chi_\perp$, the parallel susceptibility varying in the usual way. A quadratic temperature dependence has been established for $\chi_{\parallel}$. A possible magnetic structure of $CuSO_4$ is discussed.

538.2 : 548.5

GROWTH OF SINGLE CRYSTALS OF MAGNETIC GARNETS.
See Abstr. 8990

538.27

9794. ON THE PROBLEM OF THE WIDTH OF FERROMAGNETIC RESONANCE LINES.

A.I.Akhiezer, V.G.Bar'yakhtar and M.I.Kaganov.

Fiz. Metallov. i Metallovedenie, Vol. 6, No. 5, 932-4 (1958).

In Russian.

Using only simple physical considerations, the authors derive expressions for the broadening of ferromagnetic resonance lines due to exchange interaction. The cases of anomalous and normal spin effects are both treated. A.F.Brown

538.27

9795. SPIN-WAVE ANALYSIS OF FERROMAGNETIC RESONANCE IN POLYCRYSTALLINE FERRITES. E.Schlömann.

J. Phys. Chem. Solids, Vol. 6, No. 2-3, 242-56 (Aug., 1958).

A theory of ferromagnetic resonance is developed in which dipolar interaction is taken into account by means of the spin-wave formalism. Due to crystalline anisotropy and the polycrystalline character of the material, the homogeneous mode of precession interacts with spin waves whose wavelength is of the order of, or larger than, the average linear grain size. The moments of the absorption line are calculated for the case of vanishingly small single-crystal linewidths. Linewidth and lineshift due to crystalline anisotropy are calculated by a perturbation-like approach in which interactions which do not involve the homogeneous mode are neglected. The theory predicts a very strong frequency- and shape-dependence of the linewidth for the case in which the homogeneous mode is approximately degenerate with long-wavelength spin waves propagating in directions perpendicular to the d.c. field.

538.27

9796. MAGNETIC RESONANCE STUDIES IN THE REACTION OF NICKEL COBALT FERRITE. S.L.Blum and M.H.Sirvetz.

J. appl. Phys., Vol. 30, No. 5, 795 (May, 1959).

Results have been obtained for the line width and line shape asymmetry of magnetic resonance at 10^{10} c/s for $NiO.Fe_2O_3$ and $(CoO)0.05NiO.Fe_2O_3$ fired in the temperature range of 1100° - 1400°C. Porosity, saturation magnetization and crystal lattice parameters are also quoted. The results suggest that at the lowest firing temperature the spinel lattice consists of practically pure nickel ferrite. Cobalt is taken up at higher temperatures and the mixed nickel—cobalt ferrite reflects the composition of the starting materials for firing temperatures of 1400°C. R.Parker

538.27

9797. FERRIMAGNETIC RESONANCE LINE WIDTHS AND G-FACTORS IN FERRITES. R.L.White.

Phys. Rev. Letters, Vol. 2, No. 11, 465-6 (June 1, 1959).

These are discussed in the light of a recently developed theory for rare-earth garnets by Kittel, Portis and de Gennes (publication forthcoming). R.Parker

538.27

9798. IDENTIFICATION OF THE MAGNETOSTATIC MODES OF FERRIMAGNETIC RESONANT SPHERES.

P.Fletcher, I.H.Solt, Jr and R.Bell.

Phys. Rev., Vol. 114, No. 3, 739-45 (May 1, 1959).

A detailed comparison between the magnetostatic theory and experimental observation is given. Both the resonant field and the intensity of the magnetostatic modes are compared. The disagreement between observation of resonant fields and the static theory is about 50 G for an yttrium iron garnet sphere 1.3 mm in diameter. Inclusion of the first-order propagation corrections reduces this disagreement to less than 2 G for 29 of the 31 modes that were compared. This increased accuracy allows both a more positive identification and a more accurate determination of g-factors. A comparison of the static theory of intensities with observation has likewise been made. The observed intensities are close to the predicted intensities for some lines and from 4 to 100 times greater for others.

538.27

9799. CRYOSTAT FOR FERRIMAGNETIC RESONANCE EXPERIMENTS.

J.F.Dillon, Jr, S.Geschwind, V.Jaccarino and A.Machalett.

Rev. sci. Instrum., Vol. 30, No. 7, 559-61 (July, 1959).

A cryostat is described consisting of a glass vacuum insulated inner vessel and a Styrofoam outer vessel. The inner Dewar narrows to a fine tip containing the sample at its lower extremity where it protrudes through the outer vessel, and extends into a microwave cavity.

538.27

9800. ANTIFERROMAGNETIC RESONANCE IN $CuCl_2.2D_2O$.

M.Date.

J. Phys. Soc. Japan, Vol. 12, No. 10, 1168 (Oct., 1957).

Measurements were made of the antiferromagnetic resonance in single crystals of $CuCl_2.2D_2O$ and $CuCl_2.2H_2O$ at 16.1 kMc/s at 1.4°K. Preliminary results are reported in the form of a graph of resonance magnetic field versus crystal direction. The curves for the two crystals are similar; the resonance constant C_1 which occurs in Nagamiya's theory (Abstr. 11197 of 1954) is the same for both crystals but C_2 is smaller for the crystal involving heavy water of hydration. R.Parker

538.27

9801. ANTIFERROMAGNETIC RESONANCE IN MnF_2.

F.M.Johnson and A.H.Nethercot, Jr.

Phys. Rev., Vol. 114, No. 3, 705-16 (May 1, 1959).

Measurements of the antiferromagnetic resonance frequency, $\nu(T)$, were made on single-crystal slabs of MnF_2 in the frequency range 96 to 247.2 kMc/s and at temperatures, T, ranging from 4.2° to 64°K ($T_N = 67.7°K$). The results are in general agreement with the resonance relations derived for antiferromagnetic materials by Nagamiya, Keffer, and Kittel, and others. At low temperatures, values of $\nu(T)/\nu(0)$ and $\nu(0)$ are consistent with spin-wave method calculations of the sublattice magnetization and of the value and temperature dependence of the anisotropy energy. This agreement indicates almost complete correlation of adjacent electron spins in the low-temperature range as predicted from spin-wave theory. From the antiferromagnetic resonance measurement of $\nu(0) = 261.4 \pm$ $\pm$ 1.5 kMc/s and Oguchi's calculation of H_A, $z|J|$ is 3.94×10^{-15} erg in agreement with other determinations. Antiferromagnetic resonance line widths were measured from 4.2° to 64°K. The observed asymmetric line shapes are satisfactorily accounted for as arising from a mixing of absorption and dispersion and from reflections. A simplified line-width theory is given which satisfactorily accounts for the observed line-widths except at the lowest temperatures, whe a residual width is found. Finally, antiferromagnetic resonance measurements on two crystals, which were grown under different conditions, indicate no difference in resonance frequency or line-wid

538.2

9802. THE FORM OF THE LAWS OF RELAXATION IN ELECTRONIC, NUCLEAR AND QUADRUPOLE MAGNETIC RESONANCE. F.Lurçat.

Ann. Phys. (Paris), Ser. 13, Vol. 3, No. 5-6, 339-76 (May-June, 195

In French.

A thesis which was defended in 1956 and is therefore somewhat dated. It discusses relaxation and particularly multiplicity of relaxation times. Relaxation equations are obtained and the saturation process is analysed for all three types of magnetic resonance There is a discussion of the validity of the concept of spin temperature. J.G.Powle

538.27 : 539.

9803. SPECTRAL DIFFUSION, PHONONS, AND PARAMAGNETI SPIN-LATTICE RELAXATION. P.W.Anderson.

Phys. Rev., Vol. 114, No. 4, 1002-5 (May 15, 1959).

The question of paramagnetic relaxation at low temperatures and the "phonon bottleneck" is discussed in terms of the analogy with Holstein's theory of trapping of resonance radiation in gases. It is observed that the diffusion of phonon energy to the wings of th line is the limiting process, and a new mechanism for this in dilut cases is proposed. Since this mechanism involves the spin—spin interactions as well as phonons, it provides a reason for the observed increase of relaxation rate with concentration.

538.

9804. A THREE-CENTIMETRE AUTODYNE RADIOSPECTROSCOPE FOR OBSERVING PARAMAGNETIC ELECTRON RESONANCE. S.A.Akhmanov, S.D.Gvozdover, Yu.S.Konstantinov and I.T.Trofimenko.

Pribory i Tekh. Eksper. 1959, No. 2, 38-40 (March-April).

In Russian.

Describes experiments using a 3-cm travelling-wave valve wi external feed-back circuit including variable attenuator, phase shifter, filter resonator, amplifier pick-up, and ferrite parasitic decoupling. The two test samples illustrated by oscillograms contained 10^{-6} mole diphenyltrinitrophenylhydroxyl and 2×10^{-8} mole hydroxyl. The sample is located in the filter resonator which is situated in turn in the 3 kG field of an electromagnet modulated at 50 c/s. The hydroxyl sample gave a signal/noise ratio of not less

an 5. The sensitivity can be roughly doubled by using a pre-mplifier in front of the crystal detector or by super-regenerative peration. Advantages of this type of radiospectrometer are listed.
D.E.Brown

538.27

305. THE CONTRIBUTION OF BRAGG REFLECTIONS TO THE ELAXATION OF THE ELECTRON PARAMAGNETIC RESONANCE F SODIUM. A.Bassompierre.
.R. Acad. Sci. (Paris), Vol. 248, No. 4, 541-2 (Jan. 26, 1959). In rench.

The paper discusses the relaxation of the conduction electron pin system in metallic sodium due to electron—phonon collisions ncluding the relative contribution of normal and umklapp processes s a function of temperature.
J.M.Baker

538.27

806. PARAMAGNETIC RESONANÇE OF Fe^{3+} IN SAPPHIRE AT OW TEMPERATURES. G.S.Bogle and H.F.Symmons.
roc. Phys. Soc., Vol. 73, Pt 3, 531-2 (March, 1959).

Paramagnetic resonance measurements were performed at Gc/s between 299 and 4.2°K on two specimens of sapphire containg different quantities of Fe^{3+}. The results are more extensive han, but in general agreement with, those of Kornienko and Prokorov (1957), and the signs of some of the terms in the spin Hamilnian were measured. In zero magnetic field the spin doublets of he ground state occur at 0, 12.0 and 31.3 Gc/s and the admixture of tates is such as to make the specimen suitable for a solid state naser.
J.M.Baker

538.27

307. PARAMAGNETIC RESONANCE IN SINGLE CRYSTALS OF iC DOPED WITH N, P, B OR Al. J.S.van Wieringen.
emiconductors and phosphors. See Abstr. 9597, pp. 367-70.

The paramagnetic resonance absorption curves at liquid N emperatures and 3 cm wave length were measured. The spectra re completely different for n- and p-type crystals. In p-type SiC he resonance is due to electrons, the electron centres being ocated near one or more nitrogen nuclei and being isotropic. In -type SiC the resonance is due to holes, and the hole centres show nisotropic behaviour.
J.B.Birks

538.27

808. ELECTRON SPIN RESONANCE AND THE STRUCTURE OF OME STABLE FREE RADICALS. G.Berthet.
nn. Phys. (Paris), Ser. 13, Vol. 3, No. 9-10, 629-81 (Sept.-Oct., 1958). n French.

A study of the stable free radicals DPPH [$(C_6H_5)_2N_2C_6H_2(NO_2)_3$], PPOH [$(C_6H_5)_2N\,NO\,C_6H_2(NO_2)_3$] and DPANO [$(CH_3OC_6H_4)_2NO$] as a ingle crystal, a powder, melting, in liquid solution in benzene tc., and in solid solution in polymethylmethacrylate etc., at 400 Mc/s, mainly at room temperature. Hyperfine structure was bserved in many cases, usually not well resolved. The solutions n plastics show structure at much higher concentrations than in iquids and are assymmetric. The single crystal absorption is nisotropic. The results are interpreted, according to the situation, n terms of exchange narrowing, hyperfine interaction with N^{14} both ipolar and Fermi. The anisotropy in the single crystal is explained n terms of the diamagnetic anisotropy of the benzene rings. No etailed analysis of the hyperfine splitting is attempted. The tructure of single crystals of DPPH is seriously affected by enzene of crystallization. DPPH is piezoelectric.
J.G.Powles

538.27

809. PARAMAGNETIC RESONANCE SPECTRUM OF Cr^{+++} IN MERALD. J.E.Geusic, M.Peter and E.O.Schulz-Du Bois.
ell Syst. tech. J., Vol. 38, No. 1, 291-6 (Jan., 1959).

Observed at X-band (8.2 to 12.4 kMc/s), K-band (18 to 6.5 kMc/s) and M-band (50 to 75 kMc/s). From spectra observed t these frequencies, the spectroscopic splitting factors $g_{\parallel}$, $g_{\perp}$ and) were determined. The large value of D observed suggests the ossible use of emerald as an active material in relatively high nicrowave-frequency solid-state masers.

538.27

810. PARAMAGNETIC RESONANCE LINE SHAPES. P.Swarup.
anad. J. Phys., Vol. 37, No. 7, 848-57 (July, 1959).

A study of the line shape of the transitions of various concenrations of Cr^{+++} ion in potassium cobalticyanide and potassium luminum alum single crystals has been made at 9300 Mc/s. The ine shape is found to change gradually from Lorentzian to Gaussian vith chromium concentration. Lorentzian shape of gadolinium ion n lanthanum ethyl sulphate and exchange narrowing in case of free radical and copper sulphate are reported. The line width and relative intensity of the transitions in a highly dilute cyanide salt at 4.2°K are plotted and it is found that the intensity followed the maximum of the matrix element squared for various transitions. The value of g is found to be 1.992. The actual concentration of Cr^{+++} in dilute salts is less than the concentration of the solution from which they are grown by more than a factor of 10 as the dilution is increased.

538.27

9811. MEASUREMENTS OF THE SPIN—LATTICE RELAXATION TIMES OF Cr^{3+} IN CORUNDUM. P.P.Pashinin and A.M.Prokhorov.
Zh. eksper. teor. Fiz., Vol. 34, No. 3, 777 (March, 1958). In Russian. English translation in : Soviet Physics—JETP (New York), Vol. 34(7), No. 3, 535 (Sept., 1958).

The spin—lattice relaxation times were measured by a saturation method with the external magnetic field parallel to the crystal axis. At 300°K, $T_1 = 1.4 \times 10^{-7}$ sec and at 77°K, $T_1 = 7 \times 10^{-4}$ sec, suggesting that T_1 varies as about T^7 and indicating that "Raman processes" are the basic relaxation mechanisms in this temperature range.
J.M.Baker

538.27

9812. E.S.R. LINE WIDTHS OF SOME DPPH DERIVATIVES.
R.G.Bennett and A.Henglein.
J. chem. Phys., Vol. 30, No. 4, 1117-18 (April, 1959).

The powder samples of four DPPH (1,1-diphenyl-2-picryl hydrazyl) derivatives studied show considerable variation in line width. The results of these measurements are compared with those of a similar nature made by Walter, Codrington, D'Adamo and Torrey, Abstr. 7532 (1956).
J.M.Baker

538.27 : 539.21

9813. EPR STUDIES OF ELECTRON IRRADIATED ICE AND SOLID HYRODGEN.
L.H.Piette, R.C.Rempel, H.E.Weaver and J.M.Flournoy.
J. chem. Phys., Vol. 30, No. 6, 1623-4 (June, 1959).

Ice irradiated at 77°K gave a strong resonance at about $g = 2$ consisting of a doublet and other unresolved lines, possibly due to OH radical, but no splitting due to H atoms was found. Irradiations at 4.2°K produced in addition a H atom hyperfine structure of two lines 250 G on either side of $g = 2$. Irradiation of solid H_2 at 4.2°K gave resonances corresponding only to H atoms. The dosage varied from 4.5×10^5 to 4.5×10^7 rad and the effects of different dosages are discussed.
J.M.Baker

538.27

9814. PARAMAGNETIC LINE WIDTHS IN GASEOUS ATOMIC HYDROGEN. A.F.Hildebrandt, F.B.Booth and C.A.Barth.
J. chem. Phys., Vol. 31, No. 1, 273 (July, 1959).

Measurements have been made of the paramagnetic resonance spectrum of gaseous atomic hydrogen, over the range of hydrogen atom density from 1×10^{16} per cm^3 to 7×10^{15} per cm^3 in which range the line width is determined by lifetime limiting processes and magnetic inhomogeneities. The value obtained for the ratio of line width, measured between points of maximum and minimum gradient, ΔH, to the density of hydrogen atoms per cm^3, n, is $\Delta H/n = 3.5 \times 10^{-17}$ gauss cm^3 per atom.
S.A.Ahern

538.27

9815. ELECTRON PARAMAGNETIC RESONANCE SPECTRUM OF HYDROGEN ATOMS STABILIZED ON SOLID SURFACES.
N.N.Bubnov, V.V.Voevodskii, L.S.Polyak and Yu.D.Tsvetkov.
Optika i Spektrosk., Vol. 6, No. 4, 565-6 (April, 1959).
In Russian.

It was reported earlier that H atoms, formed by γ-irradiation of frozen hydrocarbons and other compounds, can be stabilized on various surfaces. The present paper reports studies of the effect of the nature of the stabilizing surface on the magnitude of hyperfine splitting of the electron paramagnetic resonance (e.p.r.) spectra of such H atoms and the width of the e.p.r. absorption lines. The H atoms were stabilized on quartz, silica gel and molybdenum glass. They were formed by irradiation of these three substances with γ-rays at 77°K (formation of H atoms is assumed to be due to rupture of bonds in H_2O molecules absorbed on these surfaces or rupture of bonds in SiOH groups). It was found that the hyperfine splitting in the e.p.r. spectra of H atoms stabilized on these surfaces is close to the hyperfine splitting of free atoms, which suggests that the binding of H atoms to these surfaces does not alter greatly the spin density of the unpaired electron in hydrogen. On the other hand, dependence of the width of the hydrogen doublet components on the nature of the stabilizing surface indicates that there is a definite interaction between the unpaired electron and the surface.
A.Tybulewicz

538.27

9816. **THEORY OF THE ELECTRON SPIN RESONANCE OF BENZENE IN THE TRIPLET STATE.** H.F.Hameka.
J. chem. Phys., Vol. 31, No. 2, 315-21 (Aug., 1959).

The splitting of the energy levels of the lowest triplet state of the benzene molecule is calculated, with the aid of first-order perturbation theory, from antisymmetricized wave-functions, which are composed of linear combinations of Slater orbitals. In the absence of an exterior magnetic field the triplet levels are split as a consequence of the spin—spin interaction; the effect of spin—orbit interaction may be neglected. The result is a doublet and a singlet; the separation of the two levels is 0.15 cm $^{-1}$ for the $^3B_{1u}$ state and 0.09 cm $^{-1}$ for the $^3B_{2u}$ state.

538.27

9817. **ELECTRON SPIN RESONANCE OF ULTRAVIOLET IRRADIATED COMPOUNDS. I. UNSATURATED HYDROCARBONS.** C.P.Poole, Jr, and R.S.Anderson.
J. chem. Phys., Vol. 31, No. 2, 346-54 (Aug., 1959).

Trapped radicals, formed by ultraviolet irradiation of pure, unsaturated aliphatic hydrocarbons maintained at 77°K, were observed with a 3 cm electron spin resonance spectrometer at a g factor of 2. Straight-chain alkene radicals were characterized by well-resolved hyperfine structure of four or more components. Branched-chain alkene radicals showed more but poorly resolved components. Only those hydrogen atoms attached to carbon atoms at or adjacent to the location of the unpaired electron are found to contribute appreciably to the observed hyperfine structure. Their hyperfine coupling constants are approximately equal. Radical formation and stabilization is attributed to the separation from the parent molecule of highly mobile hydrogen and methyl radicals which diffuse away from the remaining radical fragments, and eventually react with their environment or recombine. Stabilization of remaining fragments then occur because of immobility and structural resonance. The number of radical signs detected was of the order of 10^{16} to 10^{18} in 1 ml. samples. Most radicals were stable for weeks at 77°K. Consideration is given to the existence of radicals resulting from secondary hydrogen addition reactions.

538.27

9818. **THE PARAMAGNETIC RESONANCE ABSORPTION OF SOME FREE RADICALS IN SULFURIC ACID SOLUTION.** Y.Yokozawa.
J. Phys. Soc. Japan, Vol. 13, No. 7, 727-33 (July, 1958).

The paramagnetic resonance absorptions in sulphuric acid solutions of some organic compounds, bianthrone, perylene and thio-compounds were observed at 9 kMc/s in the range from room temperature to liquid air temperature. One of these samples and the free radical of DPPH were attached to the different parts of the resonance cavity and their absorptions were separated through the difference of the static magnetic field in each position. The absorption intensities of the sample and the free radical were compared with each other and the number of unpaired electrons was calculated. In bianthrone the number was independent of temperature, while in perylene and thio-compounds it decreased with decreasing temperature. The activation energies of perylene and thio-compounds calculated from their temperature dependencies were respectively 1.7 kcal mol^{-1} and 5.8 kcal mol^{-1}.

538.27

9819. **PARAMAGNETIC RESONANCE SPECTRUM OF Mn^{++} IN NaCl SINGLE CRYSTAL.** K.Morigaki, M.Fujimoto and J.Itoh.
J. Phys. Soc. Japan, Vol. 13, No. 10, 1174-81 (Oct., 1958).

Mn^{++} concentrations of 1-3 × 10^{-4} in mole fraction were investigated. From the analysis of the spectrum, the existence of a Mn^{++}—Na^+ vacancy complex, in which a Na^+ vacancy is at one of the nearest-neighbour positions with respect to the Mn^{++} ion, has been verified at room temperature in crystals quenched from high temperatures. However, this state of Mn^{++} ion is unstable at room temperature, and such complexes diffuse through the lattice to form aggregates of Mn^{++} ions. The ground-level splitting parameters of a Mn^{++} ion accompanying a Na^+ vacancy at one of its nearest-neighbour positions have been obtained as follows: D = 137.9 ± 1 G, E = 51.4 ± 0.4 G, where D and E represent the parameters in the spin Hamiltonian,

$$D[S_z^2 - 1/3 \cdot S(S+1)] + E(S_x^2 - S_y^2),$$

in which z-axis is in the direction of Mn^{++} — Na^+ vacancy and y-axis along the cubic axis perpendicular to it.

538.27 : 539.19

9820. **NUCLEAR HYPERFINE STRUCTURE OF A HYDRAZINIC FREE RADICAL.** I.S.Ciccarello, T.Garofano and M.Santangelo.
Nuovo Cimento, Vol. 12, No. 4, 389-90 (May 16, 1959).

Electron spin resonance of the diphenyl-benzoyl-hydrazyl free radical in carbon tetrachloride solution at −20°C at X-band is described. The specimen was a 5 × 10^{-4} mol solution containing 10^{16} paramagnetic centres. The spectrum is described by a spin Hamiltonian $\mathcal{H} = g\beta H.S + AS.(I_{N_1} + I_{N_2})$; g = 2.0036, $S = \frac{1}{2}$, $I_{N_1} = I_{N_2} = 3$, A = 7.5 G. The hyperfine structure coupling is with two equivalent nitrogen nuclei. J.M.Baker

538.27

9821. **ELECTRON SPIN RESONANCE OF Z_1-CENTERS IN POTASSIUM CHLORIDE.** H.Kawamura and K.Ishiwatari.
J. Phys. Soc. Japan, Vol. 13, No. 6, 574-8 (June, 1958).

This was investigated. Since Z_1-centres are always accompanied by F-centres, the contribution from F-centres ought to be subtracted from the resultant curve in order to get the absorption curve due to Z_1-centres alone, which is found to be Gaussian with halfwidth of 79 Oe and g value 1.999. The result is analysed according to a model in which an electron is trapped by a divalent cation substituted for a cation of the bulk crystal.

538.2

9822. **ELECTRON SPIN RESONANCE OF F-CENTRES IN ALKALI HALIDE CRYSTALS (CONSIDERING THE SECOND COORDINATION SPHERE).** L.A.Schul'man.
Optika i Spektrosk., Vol. 4, No. 5, 684-7 (1958). In Russian. English summary: PB 141047T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The calculation of line widths is extended to include the effect of hyperfine interactions with second nearest neighbours. The resul are applied to NaCl and KCl crystals. A.J.Manuel

538.2

9823. **ELECTRON SPIN RESONANCE EXPERIMENTS ON DONORS IN SILICON. I. ELECTRONIC STRUCTURE OF DONORS BY THE ELECTRON NUCLEAR DOUBLE RESONANCE TECHNIQU** G.Feher.
Phys. Rev., Vol. 114, No. 5, 1219-44 (June 1, 1959).

The ground-state wave function of the antimony, phosphorus, and arsenic impurities in silicon was investigated by means of the electron nuclear double resonance (ENDOR) method. By this metho the hyperfine interactions of the donor electron with the Si^{29} nuclei situated at different lattice sites were obtained. The isotropic part of the hyperfine interaction agreed with the theory of Kohn and Luttinger (see Abstr. 4660 and 6377 of 1955) to better than 50%. From a comparison of the experimental results with their theory a value for the conduction band minimum in silicon of k_0/k_{max} = 0.85 ± 0.03 was obtained. So far no satisfactory theory exists to accour quantitatively for the observed anisotropic part of the hyperfine int action. The observed line shape agreed with the shape predicted by summing up the individual hyperfine interactions which are the caus of the broadening. The behaviour of an inhomogeneously broadened line observed under adiabatic fast passage conditions is discussed in an appendix. The electronic g-values were measured with respe to the free carriers in a degenerate n-type silicon sample. The g-value of the free carriers was found to be 1.998 75 ± 0.000 10. T deviations of the donor g-values from the above value is several parts in 10^4 and increases monotonically with increasing ionization energy of the donors. Besides the shallow donors Sb, P, and As, several other centres were investigated, but in considerably less detail. They include the chemical impurities Bi, Li, Fe, centres associated with the surface of the sample and with the heat treatme of silicon. The influence of substitutional germanium atoms on the resonance line in phosphorus-doped silicon was also investigated.

538.2

9824. **ELECTRON SPIN RESONANCE EXPERIMENTS ON DONO IN SILICON. II. ELECTRON SPIN RELAXATION EFFECTS.** G.Feher and E.A.Gere.
Phys. Rev., Vol. 114, No. 5, 1245-56 (June 1, 1959).

The different relaxation processes that connect the four energ levels in phosphorus-doped silicon were investigated experimental The relaxation time T_s ($\Delta m_s = \pm 1$, $\Delta m_I = 0$) was found to be independent of phosphorus concentration below ~ 10^{16} P/cm^3. Its value 3200 oersteds and 1.25°K was ~ 3 × 10^{+3} seconds and varied as 1 for 1.3°K < T < 2°K and as 1/T^7 for 2.5°K < T < 4.2°K. The magnetic field dependence in the 1/T region suggests a direct phonon process. In the 1/T^7 region T_s was independent of the magnetic f between 3000 and 8000 Oe. Above a concentration of 10^{16} P/cm^3 T

ried rapidly with donor concentration, dropping to 10^{-4} sec at
× 10^{17} P/cm^3. In this concentration dependent region T_S was indep-
dent of the magnetic field but depended on the number of acceptors
esent. None of the T_S mechanisms can at present be accounted for
the theories of Pines, Bardeen, and Slichter (Abstr. 5727 of 1957)
d Abrahams (Abstr. 1313 of 1958). The relaxation time
$_x(\Delta m_S = \pm 1, \Delta m_I = \;\, 1)$ was ~ 30 hr at 3000 Oe and ~ 5 hr at 8000 Oe
fair agreement with the theory of PBS. The relaxation time
$_N$ $(\Delta m_I = \pm 1, \Delta m_S = 0)$ at 1.25°K exceeded 10 hr. The effect of light
as investigated with a monochromator for $0.5 \text{ eV} < h\nu < 2 \text{ eV}$. The
mber of carriers introduced by light was obtained from the Hall
efficient. In a sample with 7×10^{15} P/cm^3, T_S was reduced to
sec by 2×10^6 electrons/cm^3. Under the same conditions the
in--spin time T_{SS} was reduced to 1 sec. The bottleneck in the
$_S$-spin exchange mechanism suggested by PBS is the spin-lattice
me of the free carriers. This bottleneck is absent in a double spin
change mechanism suggested by Anderson and is responsible for
e observed T_{SS} process. A resonant spin—spin interaction was ob-
rved between the electron bound to an iron impurity and the phos-
orus donor electron when the magnetic field at which the two reson-
nce lines overlap was traversed. The application of this "mixing"
fect to a nuclear polarization scheme is discussed. A complete
ixing of two levels was also observed in phosphorus-doped silicon
a magnetic field of 40 Oe. A spin diffusion process capable of
ansmitting a spin excitation to different parts of the resonance line
as observed in arsenic-doped silicon. This process proceeds in
screte steps with frequencies determined by the different Larmor
equencies of the Si^{29} nuclei situated at various lattice sites relative
the donor atom.

538.27

325. PARAMAGNETIC RESONANCE IN COPPER PROPIONATE
ONOHYDRATE. H.Abe.

Phys. Soc. Japan, Vol. 13, No. 9, 987-97 (Sept., 1958).

Investigated in the centimetre wavelength region in single
ystals of copper propionate monohydrate $Cu(CH_3CH_2COO)_2 \cdot H_2O$.
he spectrum obtained is not a normal one, expected for a ^2D state
Cu^{++} ions, but similar to that observed in copper acetate mono-
ydrate $Cu(CH_3COO)_2 \cdot H_2O$ and more complicated. This spectrum
n be explained by an effective spin Hamiltonian with an equivalent
in value S = 1. This may lead to the conclusion that each of the
agnetic complexes in this crystal consists of a pair of copper ions
nder a strong interaction and may be created from a bimolecular
ructure, $Cu_2(CH_3CH_2COO)_4 \cdot 2H_2O$, as in the case of the acetate.
he unit cell of this crystal contains six spatially inequivalent pairs,
which three can be derived from the others by a reflection in its
-plane. Each pair of ions in this crystal is considered to be under
very similar environment, except the direction of the pairs. The
ombicity in its crystalline field is smaller than that of the
etate.

538.27 : 539.2

ELECTRON SPIN RESONANCE IN CRYSTALS OF THE NaCl
YPE CONTAINING AN EXCESS OF METAL ATOMS.

ee Abstr. 8852

538.27

326. THREE LEVEL SPIN REFRIGERATION AND MASER
CTION AT 1500 Mc/sec.

.E.Geusic, E.O.Schulz-Du Bois, R.W.De Grasse and H.E.D.Scovil.

. appl. Phys., Vol. 30, No. 7, 1113-14 (July, 1959).

Experiments on the electronic spin system of synthetic ruby
Al_2O_3:Cr) are described. The experiments are carried out at a
mperature of 1.5°K., with the d.c. magnetic field at 90° to the
uby c-axis. The signal frequency is propagated in a helix slow-
ave structure wound on the ruby specimen. The pump frequency is
ropagated in a waveguide containing this. Normal maser operation
obtained when, considering three energy levels, the pump frequen-
y is greater than the idling frequency. In addition, when the idling-
equency is greater than the pump frequency an enhancement of the
ositive temperature population difference between the signal energy
vels, termed spin refrigeration is obtained. It is shown how ex-
eriments of this kind yield values for the ratios of spin-lattice
elaxation times. A travelling wave arrangement of the kind used in
ese experiments may prove suitable for use in a maser to operate
the frequency of the interstellar hydrogen line for radio astronomy
urposes. S.A.Ahern

538.27 : 621.375.9

827. TWO-LEVEL MASER MATERIALS. R.H.Hoskins.

. appl. Phys., Vol. 30, No. 5, 797 (May, 1959).

Inversion of electron spin levels by adiabatic fast passage has been accomplished for a number of salts at liquid helium temperatures. The relaxation time (order 10^{-2} sec) is in agreement with c.w. microwave measurements. It is pointed out that the crystalline field splitting can be used to decrease the magnetic field required for two-level maser operation. A ruby maser has worked at X band with only 500 gauss. This could be applied to the generation of higher frequencies. D.Walsh

538.27 : 539.2

THEORY OF ELECTRON-SPIN RESONANCE OF F-CENTRES.

See Abstr. 8860

538.27

9828. INTERACTION OF FIELDS IN THE OVERHAUSER EFFECT. V.M.Kontorovich.

Zh. eksper. teor. Fiz., Vol. 34, No. 3, 779-81 (March, 1958). In Russian. English translation in: Soviet Physics—JETP (New York), Vol. 34(7), No. 3, 537-8 (Sept., 1958).

It is shown that, within the framework of the relaxation theory of Bloch, relaxation transitions can change substantially the character of the saturation when two resonant fields act simultaneously on a system with a discrete spectrum. J.M.Baker

538.27

9829. ON THE SENSITIVITY OF THE AUTODYNE METHOD FOR THE OBSERVATION OF NUCLEAR MAGNETIC RESONANCE. H.Weinhold.

Exper. Tech. der Phys., Vol. 5, No. 6, 271-80 (1957). In German.

The theoretical magnitudes of the signal strength and signal—noise ratio for an ideal autodyne apparatus are calculated using the approximations of Van der Pol. A comparison is made with experimental results. A.J.Manuel

538.27

9830. A MODULATION METHOD FOR NUCLEAR RESONANCE SPECTROSCOPY WITH HIGHER RESOLUTION. H.Primas.

Helv. phys. Acta, Vol. 31, No. 1, 17-24 (1958). In German.

A sideband modulation technique for high-resolution studies, allowing direct recording of absorption or dispersion signals is discussed. The Bloch equations are solved generally for any amplitude of magnetic field modulation or radiofrequency field and the optimum conditions are considered. A.J.Manuel

538.27 : 621.373.4

9831. WIDE R.F. LEVEL R.F. UNIT FOR AN N.M.R. SPECTROMETER. K.N.Kapur and J.W.McGrath.

Rev. sci. Instrum., Vol. 30, No. 4, 272-4 (April, 1959).

An improved r.f. unit for a nuclear magnetic resonance spectrometer is described. It uses a crystal oscillator for frequency stability and positive feedback from a cathode follower to increase the effective Q of the sample r.f. coil. This unit provides an r.f. level range of 20 μV to 60 mV with little limitation on extending the range. This allows saturation studies. The circuit is well suited to direct relaxation time measurements.

538.27

9832. ANALOG COMPUTER FOR MAGNETIC RESONANCE DATA REDUCTION. R.L.Collins.

Rev. sci. Instrum., Vol. 30, No. 6, 492 (June, 1959).

An electronic integrator for the evaluation of the first moment of absorption line derivative signals, obtained with small amplitude field modulation, is described. A.J.Manuel

538.27

9833. PROTON MAGNETIC RESONANCE IN HALOALLENES. E.B.Whipple, J.H.Goldstein and L.Mandell.

J. chem. Phys., Vol. 30, No. 4, 1109 (April, 1959).

The chemical shifts and long-range spin coupling constants for chloro-, bromo- and iodoallene, obtained from measurements in dilute cyclohexane solution on the Varian 40 Mc/s spectrometer, are tabulated and discussed. J.M.Baker

538.27

9834. BROADENING OF PROTON RESONANCES IN NATURAL CRUDE OILS. J.J.Delmau and G.J.Béné.

J. chem. Phys., Vol. 30, No. 6, 1634-5 (June, 1959).

The experiment was performed on Maroc Bou Draa crude oil to demonstrate that the removal of paramagnetic centres by ultracentrifugation reduced the line width, and hence improved resolution, in the CH_3—CH_2 region of the proton resonance spectrum. J.M.Baker

538.27 : 532.783

PROTON MAGNETIC RESONANCE IN LIQUID CRYSTALS. See Abstr. 9309-11

538.27

9835. PROTON SPIN RELAXATION IN AQUEOUS SOLUTIONS OF PARAMAGNETIC IONS. II. Cr^{+++}, Mn^{++}, Ni^{++}, Cu^{++}, AND Gd^{+++}. L.O.Morgan and A.W.Nolle.
J. chem. Phys., Vol. 31, No. 2, 365-8 (Aug., 1959).

For previous work see Abstr. 6400 (1957). Nuclear magnetic relaxation times for protons in dilute aqueous solutions of chromic, manganous, nickel, cupric, and gadolinium ions were measured in the frequency range 1.9 to 60 Mc/s. Results were interpreted in terms of Solomon's formulation of electron–nuclear dipole–dipole interaction and Bloembergen's expression for scalar coupling of electron and nuclear spins. In large magnetic fields relaxation times were found to be shorter than those expected on the basis of low field values, suggesting that the effective ion magnetic moments, electron spin relaxation times, and/or electron-nuclear spin exchange constants are field-dependent.

538.27

9836. DEUTERON MAGNETIC RESONANCE SPECTRUM AND RELAXATION IN KD_2PO_4. J.L.Bjorkstam and E.A.Uehling.
Phys. Rev., Vol. 114, No. 4, 961-8 (May 15, 1959).

The electric field gradient (EFG) tensor at the site of the deuteron in the hydrogen bond of KD_2PO_4 and the relaxation times of the deuteron were studied. The measured quadrupole coupling constant is 119 kc/s, the asymmetry parameter is 0.049, and the major principal axis of the tensor is along the bond direction. None of these features of the EFG tensor change appreciably with temperature over the entire range studied, which range includes the ferroelectric Curie point T_C. An interesting additional splitting in the spectral lines below T_C is observed, however. The thermal relaxation time of the deuteron was studied carefully only at room temperature. One obtains $T_1 = 6.5$ min at a particular orientation of the crystal decreasing by a factor of 2 at other particular orientations. T_2 is of the order 5×10^{-4} sec. All deuterons have the same relaxation as a function of crystal orientation although falling into distinct categories from the point of view of relative orientation of electric field gradient tensor and applied magnetic field. This interdependence of deuterons in different environments and the possible causes of relaxation are discussed.

538.27 : 541.183

9837. NUCLEAR MAGNETIC RESONANCE STUDY OF WATER ADSORBED ON SILICA GEL. K.Kamiyoshi.
J. Phys. Radium, Vol. 20, No. 1, 60 (Jan., 1959). In French.

The line-width decreases from 200 milligauss to 10 milligauss as the water content increases from 0.1 to 0.7 gram per gram of silica gel. E.F.W.Seymour

538.27

9838. NUCLEAR MAGNETIC RESONANCE OF WATER SORBED ON FIBROUS MATERIALS. A.Odajima, J.Sohma and S.Watanabe.
J. chem. Phys., Vol. 31, No. 1, 276-7 (July, 1959).

Measurements were made of the widths of n.m.r. signals from water molecules sorbed on mulberry paper (a form of cellulose) at 20°C over a range of water concentrations from 10% to 180%. The variation in line width with concentration is plotted and compared with similar results obtained by other workers. Relevant information obtained from dielectric measurements is discussed. A mechanism for the behaviour of the sorbed water molecule is suggested; and an extension of the experimental work to include measurements of spin-lattice relaxation times is also described. S.A.Ahern

538.27

9839. MOLECULAR MOTION IN POLYETHYLENE. II. D.W.McCall, D.C.Douglass and E.W.Anderson.
J. chem. Phys., Vol. 30, No. 5, 1272-5 (May, 1959).

Nuclear magnetic relaxation times T_1 and T_2 were measured in various polyethylene melts to 200°C. Two distinct T_2's can be resolved in all cases but single T_1's were found. T_1 is never equal to T_2. A self-consistent explanation is offered in terms of the theory of Kubo and Tomita (see Abstr. 2881 of 1955) as modified by (1) the assumption of a very broad distribution of motional correlation times, and (2) the assumption of a "two-phase" structure of the polymer melt.

538.2

9840. EFFECTS OF THE Co^{59} H.F.S. ON THE F^{19} HIGH-FREQUENCY N.M.R. IN ANTIFERROMAGNETIC CoF_2. V.Jaccarino.
J. chem. Phys., Vol. 30, No. 6, 1627-8 (June, 1959).

Indirect evidence for the h.f.s. of Co^{59} was obtained from two kinds of experiments. These were, the measurement of the frequency dependence of $T_1(F^{19})$ and the study of the saturation of the F^{19} nuclear moment by fields off-resonance. It is suggested that energy interchange between the F^{19} spin system and either electron or phonons takes place via the Co^{59} spin system. D.J.Olive

538.2

9841. SPIN–LATTICE RELAXATION AND NUCLEAR MAGNET RESONANCE IN SALTS OF THE RARE-EARTH ELEMENTS. K.A.Valiev.
Fiz. Metallov i Metallovedenie, Vol. 6, No. 2, 193-202 (1958). In Russian.

The possibility of experimentally observing nuclear magnetic resonance in paramagnetic rare-earth ions is considered. The article calculates the possibility of relaxation transitions between hyperfine ionic sublevels in the ethyl sulphates of the rare-earth elements. The calculated probabilities for nuclear spin-relaxation transitions are compared with those for electron spins. They are usually ~ 100 times smaller for ions with an odd number of 4f electrons, and ~ 10^5 smaller for ions with an even number. The probabilities of two-phonon processes and quadrupole relaxation are also calculated and shown to be small compared with those for magnetic relaxation. It is concluded that for the rare-earth ions the effect will only be observable at low temperatures.
M.G.Priestle

538.2

9842. MEASUREMENT OF FREE INDUCTION DECAY TIME AN SPIN–LATTICE RELAXATION TIME OF BROMINE NUCLEUS IN SODIUM BROMATE. T.Hashi.
J. Phys. Soc. Japan, Vol. 13, No. 8, 911-17 (Aug., 1958).

Using transient techniques, the free induction decay time T_2^* and the spin–lattice relaxation time T_1 were measured for $Br^{79,81}$ in $NaBrO_3$ at room temperatures. The free induction decay curves were well described by Gaussian curves, with $T_2^* = 10.2 \times 10^{-5}$ sec for Br^{79}, and 9.8×10^{-5} sec for Br^{81}. Comparison was made with the results of steady-state measurements. The measured values of T_1 were 2.1×10^{-3} sec for Br^{79}, and 3.0×10^{-3} sec for Br^{81}. The agreement of the ratio $T_1(Br^{81})/T_1(Br^{79}) = 1.4$ with the known ratio $Q^2(Br^{79})/Q^2(Br^{81}) = 1.44$ indicates that the quadrupole relaxation is principally responsible spin–lattice relaxation. The apparatus and procedures are also described in some detail.

538.2

9843. NUCLEAR MAGNETIC RESONANCE STUDIES OF IODINE IONS IN AQUEOUS SOLUTION. J.Itoh and Y.Yamagata.
J. Phys. Soc. Japan, Vol. 13, No. 10, 1182-6 (Oct., 1958).

Chemical shift and line width were measured for the nuclear magnetic resonance of iodine nuclei in aqueous solutions of alkali iodides. The chemical shift was independent of temperature, but was dependent on the concentration of the solution. The spin–lattice relaxation time, calculated from the line width, varied with temperature as well as with concentration. The general trend of the variation of the spin–lattice relaxation time agrees with that o viscosity. By analysing the data of the chemical shift and spin–lattice relaxation time, it is suggested that even in very dilute sol tion there exists chemical shift of the order of 6×10^{-4} as compared with the case of the "pure ion".

538.

9844. Pt^{195} NUCLEAR MAGNETIC RESONANCE IN METALLIC PLATINUM. T.J.Rowland.
J. Phys. Chem. Solids, Vol. 7, No. 1, 95-8 (Oct., 1958).

The resonance associated with Pt^{195} in the metal at 25° C is at lower frequency by 3.52 ± 0.01 per cent relative to the resonance 1M aqueous chloroplatinic acid. The frequency drift is temperatu dependent and at 78° K is −4.154 ± 0.001 per cent. Values of T_1 equal to 7.5×10^{-3} sec at 298° K and 21×10^{-3} sec at 78° K were measured. A possible interpretation of these results is given.
D.J.Oliv

538.27 : 539.4.

9845. NUCLEAR MAGNETIC RESONANCE IN ROLLED COPP SHEET. E.A.Faulkner.
Nature (London), Vol. 183, 1043-4 (April 11, 1959).

The Cu^{63} resonance is observed at 5.5 Mc/s for rolled coppe eet with up to 90% reduction in thickness. Anisotropy of absorpn is observed. The effect of annealing is investigated.

J.G.Powles

538.27

46. APPARATUS FOR NUCLEAR QUADRUPOLE RESONANCE SSERVATION. É.I.Fedin and Yu.S.Konstantinov.
ibory i Tekh. Eksper., 1959, No. 2, 27-30 (March-April).
Russian.

Discusses the advantages and establishes the mathematical sis of a spectrometer recording the second harmonic of the sonance signal. The variation cycle of the oscillator-detector equency can take 5, 20, 80, or 320 min. Absorption lines in the nge 10-800 kc/s can be traced. The autodyne is modulated at c/s. A detailed circuit is shown of the 86 c/s amplifier with a nd-width of 0.8 c/s, and of the synchronous detector and frequency ubler. The minimum concentration of Cl^{35} (in $NaClO_3$) for a cordable signal of line-width 1 kc/s is 10^{21} cm^{-3}. D.E.Brown

538.27

47. OBSERVATION OF PURE QUADRUPOLE RESONANCE NES. V.S.Grechishkin.
ibory i Tekh. Eksper., 1959, No. 2, 31-3 (March-April).
Russian.

Describes an apparatus of good sensitivity and small line-stortion incorporating Wang's autodyne detector for reproducing e lines, or a self-quenched super-regenerative circuit for unfam-ar cases where sensitivity is more important than distortion. e output stage is a modification of Shuster's phase-detector. A mple of 50 g $KClO_3$ at liquid-air temperature gave a signal/noise tio of 120 on the oscilloscope. Reproductions include circuits and e Cl^{35} quadrupole resonance in $Sr(ClO_3)_2$. D.E.Brown

538.27

48. NUCLEAR QUADRUPOLE RESONANCES OF NITROGEN AMINO AND AMIDO COMPOUNDS.
Kojima, M.Minematsu and M.Tanaka.
chem. Phys., Vol. 31, No. 1, 271-2 (July, 1959).

The nuclear quadrupole spectra of N^{14} were studied in samples parachloroaniline, parabromoaniline, paraphenylene diamine and ea. The results have been analysed to obtain information about e crystal structures of these materials. S.A.Ahern

538.27 : 539.19

49. FINE STRUCTURE OF THE Cl_2 QUADRUPOLE RESONANCE PECTRUM. D.C.Douglass.
chem. Phys., Vol. 31, No. 2, 504-5 (Aug., 1959).

Calculations are made which indicate that the observed splitting the Cl_2 quadrupole resonance spectrum arises from isotope fects on the thermal motions of the Cl_2 molecules. The type of otion considered is a torsional oscillation of the molecules about eir centres of gravity.

538.27

50. IODINE QUADRUPOLE RESONANCES IN ICl_3 AND AlI_3.
Hagiwara, K.Kato, Y.Abe and M.Minematsu.
Phys. Soc. Japan, Vol. 12, No. 10, 1166 (Oct., 1957).

The nuclear quadrupole resonances of I^{127} in the solid compounds ere measured using super-regenerative spectrometers. The esults are discussed and compared with those of other authors.

J.M.Baker

538.27

351. NUCLEAR QUADRUPOLE RESONANCES IN ARSENIC AND NTIMONY TRIHALIDES AND SULPHUR MOLECULAR ADDITION OMPOUNDS. S.Ogawa.
Phys. Soc. Japan, Vol. 13, No. 6, 618-28 (June, 1958).

Nuclear quadrupole resonances of I, Br, Cl, As and Sb isotopes the solids $AsCl_3$, $SbCl_3$, $SbBr_3$, AsI_3, SbI_3, $AsI_3.3S_8$, $SbI_3.3S_8$, SnI_4, $I_4.2S_8$ and $SnI_4.4S_8$ were measured. The newly obtained coupling onstants eQq and asymmetry parameters η of the I^{127} resonances at ^{0}K are as follows: eQq = 1383.03, 1402.68 Mc/s, and $\eta = 0.002$, 039 in $SnI_4.2S_8$; eQq = 1364.3, 1368.3, 1405.0 Mc/s, and $\eta = 0.00$, 00, 0.03 in $SnI_4.4S_8$. In $SnI_4.4S_8$ an additional line was observed at 9.04 Mc/s corresponding to the first resonance. The second esonance of SbI_3 was at 254.637 Mc/s with eQq = 895.83 Mc/s and = 0.565. Resonance frequencies of As^{75} in AsI_3 and $AsI_3.3S_8$ at 77^{0}K ere 29.338 and 49.501 Mc/s, respectively. The first resonance of ^{121} in SbI_3 was 25.406 Mc/s at 77^{0}K and the corresponding resonnce in $SbI_3.3S_8$ was 37.461 Mc/s at 297^{0}K. $SbBr_3$ showed two crysl forms which gave Sb^{121} coupling constants of 319.920 and 16.02 Mc/s and asymmetry parameters of 0.082 and 0.182 at 304^{0}K, espectively. On the Br resonances of $SbBr_3$ three resonance lines instead of two hitherto reported were observed in both crystal forms. Coupling constants of trihalides were compared with their chemical bond properties. The constants of AsI_3 and SbI_3 differ from those of other compounds, while their sulphur molecular addition compounds are in rather good agreement. AsI_3 showed positive temperature dependency for the arsenic isotope as for the iodine isotope.

ELECTROMAGNETISM

MAGNETOHYDRODYNAMICS

538.3 : 532.5

9852. MAGNETIC DIFFERENTIAL EQUATIONS. W.A.Newcomb.
Phys. of Fluids, Vol. 2, No. 4, 362-5 (July-Aug., 1959).

A necessary and sufficient condition is derived for a magnetic differential equation $B \cdot \nabla r = 0$ to have a single-valued solution r, where B is the field of a magnetohydrostatic equilibrium state or, more generally, any field with a system of toroidal magnetic surfaces.

538.3 : 532.5

9853. ON THE INTEGRATION OF THE EQUATIONS OF MAGNETOHYDROSTATICS FOR CONFIGURATIONS WITH AXIAL SYMMETRY. E.Canobbio and R.Croci.
Nuovo Cimento, Vol. 12, No. 2, 167-72 (April 16, 1959). In Italian.

The equations of magnetohydrostatic equilibrium are written down for a general orthogonal coordinate system, subject to the condition that the metric and the field variables are independent of one coordinate, x_3. Two such coordinate systems are treated in detail: cylindrical coordinates, and a toroidal system defined by $x = A \cos \phi$, $y = A \sin \phi$, $z = \rho \sin \theta$, where $A = R - \rho \cos \theta$, R is a constant, and x, y, z are Cartesian coordinates. In each case the equations are transformed to a new coordinate system in which one coordinate is constant along the lines of force. O.Penrose

538.3 : 532.5

9854. ON THE INTEGRATION OF THE LINEARIZED EQUATIONS OF MAGNETOHYDROSTATICS. E.Canobbio and R.Croci.
Nuovo Cimento, Vol. 12, No. 2, 173-6 (April 16, 1959). In Italian.

The method described in the preceding abstract is applied to the linearized magnetohydrostatic equations describing equilibrium configurations differing slightly from a known equilibrium configuration.

O.Penrose

538.3 : 532.5

9855. THE EFFECT OF FLUID MOTIONS ON THE STABILITY OF TWISTED MAGNETIC FIELDS. S.K.Trehan.
Astrophys. J., Vol. 129, No. 2, 475-82 (March, 1959).

The stability of twisted magnetic fields confined to an infinitely long cylinder of incompressible inviscid fluid of infinite electrical conductivity is investigated when fluid motions of varying amounts are present along the lines of force. It is found that the system is stable only when the energy in the velocity field is at least equal to that in the magnetic field.

538.3 : 532.5

9856. HYDROMAGNETIC EFFECTS UNDER CONDITIONS OF LOCALIZED THERMAL INSTABILITY. W.C.Levengood.
Astrophys. J., Vol. 129, No. 2, 483-8 (March, 1959).

Thermal convection experiments were conducted in an attempt to explain previously observed hydromagnetic effects in silver patterns deposited on glass. Convective regions were produced in alcohol and alcohol—powder mixtures by locally heating with the poles of permanent magnets. Optical and weight-difference techniques were developed to compare observed differences in the convection process over the pole regions of the magnet. These phenomena suggested electric charge effects within the liquid, and the results were found to agree with the basic electrodynamics of charges moving in a magnetic field. These force effects on charged particles also provided an explanation for the observed differences in the silver-deposit patterns. The earth's magnetic field was found to have an effect on the localized convection process. The difference over the pole regions was most pronounced when the magnet poles were aligned in the same position as the geomagnetic poles of the earth.

538.3 : 532.5

9857. MAGNETOCONVECTION IN A VISCOUS FLUID OF INFINTE ELECTRICAL CONDUCTIVITY. W.V.R.Malkus.
Astrophys. J., Vol. 130, No. 1, 259-75 (July, 1959).

A determination is made of the stable magnetic fields associated with steady-state convection in a fluid with no electrical resistance. The viscosity and thermal diffusivity which determine the amplitide of the fields are retained in the analysis. It is found that the most stable magnetic field is that one which alters the advection of momentum in a manner that minimizes the constraints on the convection. For the non-rotating fluid with small Prandtl number, the stable state is one of detailed local equipartition of magnetic and kinetic energy. For the rotating fluid the stable state can be one of vastly greater magnetic energy than kinetic energy. In speculating on the applicability of these results to astrophysical convection, it is suggested that the stable "magnetostrophic" fields are by far the largest part of the observed fields.

538.3 : 532.5

9858. ROTATION OF A CONDUCTING SPHERE IN A CONDUCTING VISCOUS LIQUID IN THE PRESENCE OF A MAGNETIC FIELD.

Yu.Krumin'.

Latv. PSR Zinat. Akad. Vestis, 1958, No. 2(127), 97-102. In Russian.

A number of methods can be devised for measuring the electrical conductivity and viscosity of liquid metals. The present paper gives the theory of one based on the braking of the motion of conducting bodies rotating in a magnetic field. This theory follows lines of that given by Tamm ("Principles of Electricity", Moscow, 1954), though this latter work simplified the problem by assuming zero liquid viscosity. An expression is derived for the braking moment acting on a non-ferromagnetic sphere. C.R.S.Manders

538.3 : 535.2

9859. ON THE STRUCTURE OF CERTAIN SHOCK WAVES IN A CONDUCTING FLUID IN THE PRESENCE OF A MAGNETIC FIELD.

P.Germain.

C.R. Acad. Sci. (Paris), Vol. 248, No. 13, 1929-31 (April 1, 1959). In French.

Generalizes some standard results of the theory of ordinary shocks to magnetohydrodynamic shocks. First, the shock conditions are considered, the analogue of the Hugoniot function is introduced, and certain qualitative results proved (for example that the motion is supersonic in front of, and subsonic behind, the shock). Then the structure of such shocks is investigated without making any special assumptions about the viscosity and the thermal and electrical conductivities. A method is outlined for showing that a suitable solution of the hydrodynamic equations actually exists for any given solution of the shock conditions. O.Penrose

538.3 : 532.5

9860. THE STABILITY OF SHOCK WAVES IN MAGNETOHYDRODYNAMICS.

S.I.Sy̆rovatskii

Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1466-70 (1958). In Russian.

The interaction between shock waves in a magnetic field and magnetohydrodynamic waves of small amplitude are considered. The condition for stability with respect to spontaneous emission of weak magnetohydrodynamic waves by a shock wave has been obtained. Conditions under which the linear equations for a small perturbation do not have a solution have been found, this case being interpreted as shock wave disintegration.

538.3 : 532.5

9861. INFLUENCE OF AN ELECTROMAGNETIC FIELD ON THE REGION OF DETONATION.

G.A.Lyubimov.

Dokl. Akad. Nauk SSSR, Vol. 126, No. 3, 532-3 (May 21, 1959). In Russian.

It is assumed that the electrical conductivity of a gas placed in a region of an electromagnetic field is initially zero, but that it rises to an infinite value after the passage of a detonation front. The electromagnetic wave is assumed to be plane while the detonation front is taken as plane or cylindrical. It is shown that the presence of an electromagnetic field causes an increase of velocity of the condensation front, which is proportional to the square of the magnetic field intensity. J.K.Skwirzynski

538.3 : 532.5

9862. SIMPLE EXAMPLES OF MAGNETOMECHANICAL WAVE MOTION.

U.Ingard.

J. Acoust. Soc. Amer., Vol. 31. No. 7, 1033-4 (July, 1959).

The phase velocity on a periodic line consisting of coupled mass elements (coils) in a magnetic field is shown to be analogous to the phase velocity of a transverse Alfvén wave in a conducting, incompressible fluid. As another example of the magnetomechanics of a simple "distributed" system, the motion of a conducting string in a magnetic field is discussed.

538.3 : 532.

9863. EFFECT OF TRANSVERSE MAGNETIC FIELD ON THE FLOW DUE TO AN OSCILLATING FLAT PLATE.

T.Kakutani.

J. Phys. Soc. Japan, Vol. 13, No. 12, 1504-9 (Dec., 1958).

The distributions of velocity, magnetic field, and related quantities — such as pressure, electric field and current density — are obtained for the flow of an incompressible, viscous and electrically conducting fluid due to an infinite oscillating flat plate in the presence of a transverse magnetic field. General solutions are first derived and then some special cases are discussed, corresponding to limiting values of parameters, such as the magnetic pressure number S and magnetic Reynolds number R_m. It is found that each of the velocity distributions and other related quantities consists of two different oscillations whose decaying factors differ from the corresponding wave-numbers. This contrasts to the well-known velocity distribution in classical hydrodynamics.

538.3 : 532.

9864. LAMINAR STEADY-STATE MAGNETOHYDRODYNAMIC FLOW IN AN ANNULAR CHANNEL.

S.Globe.

Phys. of Fluids, Vol. 2, No. 4, 404-7 (July-Aug., 1959).

The problem considered is the steady flow of an electrically conducting, incompressible fluid, in the annular space between two infinitely long circular cylinders, under a radially impressed magnetic field. The general magnetohydrodynamic equations are simplified by the conditions of the problem to three equations in pressure, velocity, and magnetic field. One equation gives the pressure variation in the radial direction; the other two are coupled equation for the velocity and the magnetic field, which are functions of the radial variable only and may be solved for in closed form. In the limiting case where the radii of the annulus become infinite, but their difference remains finite, the solution converges on the expression for magnetohydrodynamic flow between infinite planes under a transverse magnetic field.

538.3 : 532.5 : 539.

9865. SELF-CONSISTENT FIELD OF SINGLE-TYPE ELECTRONS IN A UNIFORM MAGNETIC FIELD.

L.Tonks.

Phys. Rev., Vol. 114, No. 3, 637-43 (May 1, 1959).

A problem which has been brought to the fore by Christofilos' proposed thermonuclear machine, "Astron", is that of electrons rotating in a uniform impressed magnetic field in such a way as to form a cylinder in space — a disembodied current-carrying helix. In the present paper the self-consistent magnetic field for such a "helix", infinitely long and made up of relativistic electrons of identical mass, axial velocity and canonical angular momentum, ha been calculated for the interesting range of the two pertinent parameters. The first is the ratio, denoted by g_2, of apogee radius to the radius of gyration in the impressed field. The second is the quotient of the number of electrons per classical-electron diamete along the axis and the ratio of relativistic to rest mass. It is denoted by $(2r_e/\gamma)N$ and is called the "strength" of the layer. Whe g_2 is less than 2, the trajectories of the electrons, when they are few in number, are approximately circles which include the axis. As the layer strength is increased, these trajectories stay closer and closer to the locus of apogees. The interior field never revers and approaches $2/g_2 - 1$ as the strength reaches $2(g_2 - 1)$, the larg value possible for a given g_2. When g_2 is greater than 2, the trajec ories in a weak layer are approximately circles which do not inclu the axis, but with increasing strength the perigees approach, cross and then recede from the axis. As they cross, the interior field decreases discontinuously even to the point of partial reversal. T approach to this discontinuity is attended by an enhancement of the interior field. When g_2 is greater than approximately 4, the layer strength peaks at a value in excess of $2(g_2 - 1)$ at the axis crossin and as the perigee locus then moves outward, the strength decreas toward $2(g_2 - 1)$. Thus there can be two configurations of the laye which have the same strength, one consistent with enhancement of the interior field, the other consistent with reversal.

538.3 : 532

9866. RAYLEIGH'S PROBLEM IN MAGNETOHYDRODYNAMICS

C.C.Chang and J.T.Yen.

Phys. of Fluids, Vol. 2, No. 4, 393-403 (July-Aug., 1959).

Extension of Rayleigh's problem to magnetohydrodynamics is investigated with a perfectly conducting plate and a transversely a lied magnetic field. Induced electric and magnetic fields are both included in the analysis. Results obtained show that along the plat an electromagnetic body force is acting in the direction of fluid motion. The results are found to be the same whether the applied magnetic field is fixed-in-space or attached to the moving plate.

mparison of these results with those of Rossow [National Advisory mmittee on Aeronautics, Technical notes No. 3971 (1957)] (magtic field fixed with fluid) shows opposite trends in the velocity ofile. Such discrepancies are discussed. Rossow's second case agnetic field fixed with plate) is also discussed.

538.3 : 532.5

67. THE "ADIABATIC INVARIANCE" OF THE MAGNETIC RBITAL MOMENT OF CHARGED PARTICLES.
Hertweck and A.Schlüter.
Naturforsch., Vol. 12a, No. 10, 844-9 (1957). In German.

The magnetic moment μ of the motion of a charged particle in magnetic field is an approximate constant of motion in moderately rying magnetic fields. For the special case of a homogeneous ne-dependent magnetic field, it is shown that the relative change μ between two different states of constant field decreases at least ponentially in h/α if α/h tends to zero, where α represents the lative rate of change of the magnetic field and h denotes the gyroequency.

538.3 : 532.5

68. FORCE-FREE MAGNETIC FIELDS. II. A.Schlüter.
Naturforsch., Vol. 12a, No. 10, 855-9 (1957). In German.

For previous work, see Abstr. 9902 (1954). The general lution of the differential equation of force-free magnetic fields is ven for the case of cylindrical symmetry. The energy density has fulfil two inequalities; apart from this, it can be freely chosen as nction of the distance from the axis of symmetry. The components the field as well as the electric current density follow from it rely by differentiation. By explicitly constructing a threerameter family of such force-free fields it is shown that the nount of momentum and of angular momentum transported by the eld in the direction of the axis is not determined by the total agnetic and electric flux of the field.

538.3 : 532.5

69. OSCILLATIONS OF A CYLINDRICAL CAVITY IN A OMPLETELY IONIZED PLASMA. L.M.Kovrizhnȳkh.
h. eksper. teor. Fiz., Vol. 36, No. 3, 839-41 (1959). In Russian.

Oscillations of a cylindrical cavity in a completely ionized asma located in a magnetic field are investigated within the framework of magnetohydrodynamics under the assumption of ideal conuctivity. It is shown that such a system is stable and that under efinite conditions the waves cannot propagate along the cavity.

538.3 : 532.5

370. HYDROMAGNETIC STABILITY OF A [PERFECTLY] ONDUCTING, INVISCID, INCOMPRESSIBLE FLUID OF VARIABLE ENSITY. S.P.Talwar.
. Astrophys., Vol. 47, No. 3, 161-8 (1959).

The Rayleigh instability is studied in the presence of a horiontal magnetic field. Having established the equations of the prolem, two special cases of density distribution are studied in detail. he main result is that the magnetic field has a stabilizing influence n the configuration in either case and that the magnetic field may ring about stability in the configuration when it is thoroughly unable without a field.

538.3

871. FORCES IN A POLARIZED AND MAGNETIZED BODY.
.M.Rancoita.
uovo Cimento Suppl., Vol. 11, No. 2, 183-224 (1959). In Italian.

An energy-momentum tensor is set up which includes terms rising from the electromagnetic field, electric and magnetic polariation, thermal conduction, and mechanical forces and inertia. The ensor is symmetric, the asymmetry in the electromagnetic terms eing compensated by a corresponding asymmetry in the mechanical orce tensor. The electromagnetic part is discussed in detail and ompared with the Minkowski and Abraham tensors. R.A.Newing

538.3 : 530.12

EQUATIONS OF MOTION IN LINEAR FIELD THEORIES.
ee Abstr. 9172

538.3 : 530.12

CHARGED FLUIDS OF INFINITE CONDUCTIVITY.
ee Abstr. 9184

538.3 : 530.12

CONSERVATION LAWS FOR ACTION IN ELECTROMAGNETIC IELDS. See Abstr. 9187

538.31

9872. ELECTROMAGNETIC FORCES ACTING ON A CURRENT-CARRYING CONDUCTOR PLACED NEAR A CORNER OF A FERROMAGNETIC BODY. A.M.Arakelyan.
Elektrichestvo, 1959, No. 2, 16-20 (Feb.). In Russian.

Following Mejerovitz [Phil. Mag., Vol. 25, No. 166, (1938)], the author uses the method of images to construct a complex potential for a two-dimensional system consisting of an infinite angle, containing a ferromagnetic body and a current-carrying conductor placed outside this angle. As particular examples of this method, the author determines explicitly the magnetic field intensity and hence dynamic force acting on the current, for two cases: (a) angle of the ferromagnetic body equal to $\pi/2$ and the conductor placed near one of its walls; (b) L-shaped ferromagnetic wall and two opposite currents on both sides of a single wall. J.K.Skwirzynski

ELECTROMAGNETIC WAVES AND OSCILLATIONS

538.566 : 537.533

9873. THE INTERACTION BETWEEN AN OBLIQUELY INCIDENT PLANE ELECTROMAGNETIC WAVE AND AN ELECTRON BEAM. III.
H.Wilhelmsson.
Chalmers Tekn. Hogsk. Handl., No. 206, 17 pp. (1958).

For Pt II see Abstr. 5145 (1958). This report concentrates on providing a more direct physical interpretation of some of the relations already derived. The results relate mainly to the case of zero or infinite magnetic fields in the direction of the electron beam, but some discussion of the finite field case is also presented.
E.A.Ash

538.566

9874. PROPAGATION OF RADIO WAVES ALONG AN INHOMOGENEOUS SURFACE. E.L.Feinberg.
Nuovo Cimento Suppl., Vol. 11, No. 1, 60-91 (1959).

A comprehensive account is given of a new fundamental approach to the theory of the propagation of radio waves along an electrically inhomogeneous surface, neglecting any ionospheric influences. The basic integral equation for the field at the earth's surface some distance from a radiating vertical dipole is applied to particular problems (flat and spherical earth; homogeneous and inhomogeneous surfaces; presence of corrugations; influence of a rapidly changing conductivity). Simple formulae obtained for special cases do not fully describe the phenomena but they represent a considerable extension and improvement of the classical work which was concerned only with the case of propagation over a homogeneous flat earth.
G.M.Brown

538.566

9875. ON THE GROUP VELOCITY IN MOVING CONDUCTORS.
G.Crupi.
R.C. Accad. Naz. Lincei, Vol. 25, No. 5, 280-3 (Nov., 1958).
In Italian.

538.566

9876. APPROXIMATE COMPUTATION OF THE DIFFRACTION OF PLANE ELECTROMAGNETIC WAVES AT CERTAIN METAL BODIES. II. DIFFRACTION ON A DISK AND A FINITE CYLINDER.
P.Ya.Ufimtsev.
Zh. tekh. Fiz., Vol. 28, No. 11, 2604-16 (1958). In Russian.

The methods developed by the author in a previous article (Abstr. 1615 of 1959) are applied to the calculation of the diffraction at an ideally conducting disk and cylinder of finite length. Formulae are derived for scattering characteristics and comparison is made both with exact theory and with experimental data. Accurate results are obtained only when account is taken of the secondary diffraction due to the interaction of edge currents. S.C.Dunn

538.566

9877. THE SCATTERING OF ELECTROMAGNETIC WAVES BY A CORRUGATED SHEET. T.B.A.Senior.
Canad. J. Phys., Vol. 37, No. 7, 787-97 (July, 1959).

The physical optics method is used to determine the scattering of a plane wave by a perfectly conducting sheet having sinusoidal corrugations. The only approximation concerns the current distribution on the sheets and the scattered field then appears as a spectrum of plane waves whose amplitudes are given by a simple integral expression.

538.566

9878. DIFFRACTION OF A DIPOLE FIELD BY A UNIDIRECTIONALLY CONDUCTING SEMI-INFINITE PLANE SCREEN. J.Radlow.

Quart. appl. Math., Vol. 17, No. 2, 113-27 (July, 1959).

An exact solution is obtained. Double Laplace transforms are applied to Maxwell's equations, and the defining conditions of the unidirectionality lead to an equation between two complex functions of two complex variables. This equation is solved by an extension of the usual function-theoretical method, and we can then express the electromagnetic field in terms of certain complex triple integrals. These are transformed into real integrals, so that it is possible to discuss the field behaviour in the neighbourhood of the diffracting edge. The variation of singularity along the edge of the screen is given.

538.566

9879. DIFFRACTION OF A PLANE ELECTROMAGNETIC WAVE AT AN IDEALLY CONTACTING PARABOLOID OF REVOLUTION. V.A.Fok and A.A.Fedorov.

Zh. tekh. Fiz., Vol. 28, No. 11, 2548-66 (1958). In Russian.

The wave has arbitrary polarization and falls on the outer surface of the solid at an arbitrary angle. In addition to the strict solution an asymtotic formula for the current distribution over the surface is also found. This formula is valid for the case where the wavelength is small compared with the focal length of the paraboloid.

S.C.Dunn

538.566

9880. EXPERIMENTAL DETERMINATION OF THE RADAR CROSS-SECTION OF CYLINDRICAL METAL BODIES. E.Meyer, H.Kuttruff and H.Severin.

Z. angew. Phys., Vol. 11, No. 1, 1-6 (Jan., 1959). In German.

The measurements were carried out at 3.2 cm on cylinders suspended by perlon threads, with their axis parallel or perpendicular to the polarization plane, and slowly lifted by a motor at the top of the large reflection-free room, available in Göttingen, to change the angle of incidence. The incident energy was measured by reflection from objects with known scattering cross-sections. Many results are presented in the form of polar diagrams.

H.Motz

538.566

9881. CONICAL RADIATION FROM A PROGRESSIVE WAVE IN A SLIT. J.Ernest.

C.R. Acad. Sci. (Paris), Vol. 248, No. 17, 2463-5 (April 27, 1959). In French.

A slit in a waveguide carrying a progressive wave radiates with the principal lobe in the surface of a cone of which the axis is the slit and the semi-angle is given by $\cos\theta = c/v_\phi$, where v_ϕ is the phase velocity in the waveguide. Analogies with Cherenkov radiation and with propagation in a birefringent medium are suggested.

W.T.Welford

517.9 : 538.566

ASYMPTOTICS OF PARTICULAR FUNCTIONS OF THE EQUATION $\Delta u + k^2u = 0$ WITH BOUNDARY CONDITIONS ON EQUIDISTANT CURVES

538.566 : 517.9

9882. ASYMPTOTICS OF PARTICULAR FUNCTIONS OF THE EQUATION $\Delta u + k^2u = 0$ WITH BOUNDARY CONDITIONS ON EQUIDISTANT CURVES AND DIFFUSION OF ELECTROMAGNETIC WAVES IN WAVEGUIDES. V.P.Maslov.

Dokl. Akad. Nauk SSSR, Vol. 123, No. 4, 631-3 (1958). In Russian.

The equation $\Delta\phi_k + k^2\phi_k = 0$ is examined in a region bounded by (a) two closed equidistant curves, (b) two equidistant curves and two normals to them, and (c) two infinitely-long, equidistant curves. Physical interpretation of the results, as applied to waveguides, is discussed.

P.Collins

538.566

9883. SPATIAL RESONANCE IN A HELICAL WAVEGUIDE, PLACED IN A DISPERSIVE MEDIUM. V.P.Shestopalov and B.V.Kondrat'ev.

Dokl. Akad. Nauk SSSR, Vol. 125, No. 4, 794-7 (April 1, 1959). In Russian.

Two cases are considered and discussed: (1) when the helix waveguide of radius a is placed in a channel in a dispersive medium of radius b = a, (2) when b > a. In both cases it is assumed that $2\delta \ll d$ (δ = width of the waveguide tape, d = pitch of the helix), while $d \ll$ [illegible] (λ = wavelength in free space, ψ = winding angle of the helix), the dispersion equations are obtained for slow wave modes and typical wave velocity curves are plotted against frequency for three modes and for several values of the dielectric constant ϵ (while $\mu = 1$). In the second case, under limiting conditions, an explicit form is obtained for the phase velocity of slow waves. It is found that in the first case the dispersion depends on the helix para meters only, whereas in the second case it is strongly influenced the outside medium.

J.K.Skwirzynsk

538.566 : 621.372.82

9884. IMPEDANCE AND DISPERSION CHARACTERISTICS OF THE FLATTENED HELIX. C.C.Johnson.

I.R.E. Trans Electron Devices, Vol. ED-6, No. 2, 189-94 (April, 195

Curves are presented which give the dispersion and impedance characteristics of a flattened helix in the presence of a dielectric material and a metal shield. The impedance curves are very simila to the corresponding curves for a round helix whose circumference is equal to the perimeter of the flattened helix. The flattened helix has dispersion characteristics similar to a round helix whose diameter equals the flattened helix thickness.

538.566 : 621.385.632.12

9885. AN INVESTIGATION AND APPLICATION OF THE CONTRAWOUND HELIX [IN AN X-BAND TRAVELLING-WAVE TUBE]. J.E.Nevins, Jr.

I.R.E. Trans Electron Devices, Vol. ED-6, No. 2, 195-202 (April, 1959).

An investigation of the contrawound helix and the determination of its characteristics are described. By means of a hollow-beam travelling-wave tube and perturbation methods, the fundamental and minus-one space harmonic impedances have been measured and a number of space harmonics of the symmetric and antisymmetric modes identified. The fundamental impedance was measured to be equal or greater than the sheath-helix impedance, depending however, upon the thickness and width of the helix tape. The minus-one space harmonic impedance was measured to be larger than the fundamental impedance for ka > 0.65. The contrawound helix has been employed as a high-power X-band amplifier (8.5-9.5 kMc/s). The characteristics of the tube described are 25 dB gain, power out > 1 kW, efficiency 7-10%.

538.566 : 537.56

9886. PROPAGATION OF OSCILLATIONS IN ELECTRON BEAMS WITH UNCOMPENSATED SPACE CHARGE. B.N.Rutkevich and Ya.B.Fainberg.

Zh. tekh. Fiz., Vol. 29, No. 3, 280-6 (1959). In Russian.

Slow waves are propagated in confined electron plasmas, and the latter could replace waveguides for accelerating particles and amplifying very high frequencies. If an electron cloud, uncompensated by ions of opposite charge, rotates in a magnetic field (Brillouin flow), it can in certain circumstances sustain waves of this kind. Expressions are given for the corresponding fields and velocities of propagation.

A.E.I. Research Laboratory

538.566.2

9887. ON THE THEORY OF PROPAGATION OF ELECTROMAGNETIC WAVES IN GYROTROPIC MEDIA. G.S.Krinchik and M.V.Chetkin.

Optika i Spektrosk., Vol. 6, No. 5, 703-5 (May, 1959). In Russian.

The same substance may be both gyroelectric and gyromagnetic at very high frequencies (Krinchik and Ryabchenko, Optika i Spektrosk., Vol. 2, 537, 1957). The present note shows how it is possible to determine experimentally whether, at a given frequency, a medium is gyroelectric, gyromagnetic or simultaneously possesses these two properties (bigyrotropic).

A.Tybulewicz

538.566.2 : 535.399 : 539 23

ELECTROMAGNETIC WAVE ABSORPTION IN THIN METALLIC FILMS. See Abstr. 8900-2

538.566.2 : 537 56

ABSORPTION OF ELECTROMAGNETIC WAVES WITHIN THE RESONANCE RANGES OF AN INHOMOGENEOUS PLASMA. See Abstr. 9733

538.566.3 : 551.510.535

9888. INTERPRETATION OF THE VARIATION OF IONOSPHERIC ABSORPTION AS A FUNCTION OF FREQUENCY. K.Bibl, A.Paul and K.Rawer.

C.R. Acad. Sci. (Paris), Vol. 248, No. 7, 949-52 (Feb. 16, 1959). In French.

Noon ionospheric absorption measurements on eight frequencies at Fribourg have been compared with various expressions for the variation with frequency, and it is found that when there are appreciable departures from a relation given by the authors, an Es layer

s usually present. The relation takes account of both non-devi-
ve (D region) and deviative (E region) absorption. Results for
nmer 1958 indicate that deviative absorption increases with
ar altitude, while non-deviative absorption decreases. The
mer change corresponds approximately with the decrease of h'E.
G.M.Brown

NUCLEAR AND ATOMIC PHYSICS

APPARATUS . PARTICLE DETECTORS

539.1.07
89. MICRO-COUNTER TUBES FOR BETA–GAMMA MEAS-
EMENTS. G.L.Locher.
ernat. J. appl. Radiation and Isotopes, Vol. 4, No. 1-2, 112-16
ec., 1958).
Constructional details, operating characteristics etc. of small
aze-type Geiger counters are given. Tube diameters varied from
6 mm, and lengths from 5-30 mm. Response to certain β- and
rays was measured and data are tabulated. J.D.Craggs

539.1.07
90. THERMAL RESISTANCE OF HALOGEN COUNTERS.
.G.Chaikovskii.
ribory i Tekh. Eksper., 1959, No. 1, 65-6 (Jan.-Feb.). In Russian.
A possibility of making temperature-independent halogen-
ienched counters was investiaged. Shows that the variation of the
aracteristics with temperature is caused by the products of an
teraction of halogen with materials of the counter body. Removal
these products before subsequent filling extends the temperature
dependence to 170°-200°C. J.M.Zarzycki

539.1.07 : 537.591
ON THE STANDARD COSMIC-RAY MESON MONITOR.
ee Abstr. 9734

539.1.07
891. A PROPORTIONAL COUNTER FOR THE MEASUREMENT
F WEAK ACTIVITIES INVOLVING SOFT β-RAYS.
.G.Houtermans and H.Oeschger.
elv. phys. Acta, Vol. 31, No. 2, 117-26 (1958). In German.
Describes the construction and use of a special large volume
ounter for weak activities. An anti-coincidence arrangement is
sed, giving, for example, background counts for the counter as a
hole of about 0.8 per min. Background effects are discussed.
J.D.Craggs

539.1.07
892. CURRENTS INDUCED IN THE DIELECTRICS OF
ONIZATION CHAMBERS THROUGH THE ACTION OF HIGH-
NERGY RADIATION. H.E.Johns, N.Aspin and R.G.Baker.
adiation Research, Vol. 9, No. 6, 573-88 (Dec., 1958).
Details are given of theoretical and experimental investigation
f the polarity effect in parallel-plate ion chambers, which, it is
oncluded, is due to interaction of high-energy radiation in the col-
ecting electrode and its dielectric insulator. Obtained sets of
urves can be used for calculation of the effect for any parallel-
late ion chamber measuring Co^{60} radiation. J.M.Zarzycki

539.1.07 : 537.591.2
893. A METHOD FOR THE MEASUREMENT OF THE ENERGY
F PARTICLES IN A RANGE ABOVE 10^{11} eV.
.L.Grigorov, V.S.Murzin and I.D.Rapoport.
h. eksper. teor. Fiz., Vol. 34, No. 2, 506-7 (1958). In Russian.
nglish summary: PB 141052T-1, obtainable from Office of
echnical Services, U.S. Dept. of Commerce, Washington, D.C.,
.S.A.
Uses the total energy emitted by the secondaries produced in a
ense medium. The apparatus consisted of a pyramid of 6 layers of
onization chambers (total number 105) between layers of iron (total
hickness 85 cm) and a counter telescope. Several cases recorded
t an altitude of 3860 m above sea-level are reported.
E.J.Burge

539.1.07
9894. USE OF SPARK COUNTERS IN DETECTION OF FAST NEUTRONS. M.Nakhman, L.Shekhter and Kh.Totsia.
Rev. de Physique (Bucarest), Vol. 3, No. 3-4, 203-10 (1958).
In Russian.

Reports on the use of the Chang–Rosenblum spark counters (Abstr. 1942 of 1945) in detection of neutrons with energies of several MeV. The counters were filled with nitrogen, air or hydrogen. Neutrons were detected by means of recoil nuclei (protons or heavier particles). The counters have the advantage of insensitivity to γ-rays but their efficiency is low (10^{-3}-10^{-4}%). They need an external quenching circuit and consequently their resolution time is long. They also require a voltage source capable of providing 10^3-10^4 V. A.Tybulewicz

539.1.07
9895. A SIMPLE GAMMA-RAY INSENSITIVE FAST-NEUTRON COUNTER. G.M.Griffiths, P.P.Singh, Y.I.Ssu and J.B.Warren.
Canad. J. Phys., Vol. 37, No. 7, 858-65 (July, 1959).

A gamma-ray insensitive fast-neutron counter is described which consists of a number of thin rectangular sheets of lucite coated with zinc sulphide and sandwiched together to form a rectangular block which is mounted on a photomultiplier. Pulse height spectra and absolute effeciency curves are presented for neutrons from 300 keV to 15 MeV.

539.1.07
9896. THE FIELD γ-RADIOMETER SG-42.
M.M.Sokolov and N.I.Karabanov.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 1, 88-9 (1958).
In Russian. English summary: PB 141041T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

A portable (5 kg) γ-radiation meter, using a 3 cm dia. × 2.5 cm long NaI(Tl) crystal scintillation counter, has been developed, mainly for geological prospecting. The instrument has 3 sensitivity ranges, and a circuit diagram is given. J.B.Birks

539.1.07
9897. A SCINTILLATION METHOD FOR THE CONTROL OF β-CONTAMINATIONS IN THE PRESENCE OF A γ-BACKGROUND. G.M.Dikareva.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 1, 90-3 (1958).
In Russian. English summary: PB 141041T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

K is defined as the ratio of the counting efficiency of a scintillation counter for β-rays (Sr^{90}-Y^{90}) and for γ-rays (Co^{60}). K has been measured as a function of scintillator thickness for ZnS–Ag layers, for stilbene monocrystals and for a plastic scintillator (tetraphenylbutadiene in polystyrene). For ZnS–Ag, K is a maximum at a thickness of 45 mg/cm^2; for stilbene and the plastic scintillator K increases with decreasing thickness, down to the minimum values of 12 mg/cm^2 and 7.2 mg/cm^2 respectively that were used.
J.B.Birks

539.1.07
9898. PARTICLE SELECTION IN CRYSTALS OF CsI(Tl).
J.C.Robertson and A.Ward.
Proc. Phys. Soc., Vol. 73, Pt 3, 523-5 (March, 1959).

The dependence of the decay time of scintillations in CsI(Tl) crystals on the density of ionization is utilized in a gating system which discriminates against electrons in favour of more densely ionizing particles such as alpha-particles. Electronic circuit details and typical results showing the discrimination are included.
G.F.J.Garlick

539.1.07
9899. REDUCTION OF BACKGROUND FOR MEASUREMENTS OF SMALL ACTIVITIES IN LIQUID SCINTILLATION COUNTERS.
D.G.Fleishman and L.G.Shakhidzhanyan.
Pribory i Tekh. Eksper., 1959, No. 1, 135-6 (Jan.-Feb.). In Russian.

Results of an investigation of the radioactivity of materials used in liquid scintillation counters are given. Considerable residual activity was found in the glass and mica used in photomultipliers and in the glass containers (β-rays of K^{40}). Suggests the use of molybdenum glass, quartz and plexiglass for the reduction of residual activity. See also Abstr. 5972 (1956). J.M.Zarzycki

539.1.07

9900. IMPROVING THE STABILITY OF OPERATION OF SCINTILLATION COUNTERS. A.M.Ivanchenko.
Pribory i Tekh. Eksper., 1959, No. 2, 150-1 (March-April). In Russian.

Describes briefly a stabilizing device consisting of a discriminator and an integrating circuit. It is connected to the output of the linear amplifier and its output is fed into one of the dynodes of the photomultiplier, or to the control grids of variable-mu pentodes of the linear amplifier. J M.Zarzycki

539.1.07

9901. COSMIC-RAY TRACKS IN FILAMENT SCINTILLATION CHAMBERS. G.T.Reynolds, R.Giaconni and D.Scarl.
Rev. sci. Instrum., Vol. 30, No. 6, 497-8 (June, 1959).

The quality of several types of photomultiplier image tubes was tested and it was found that background light from the tube provides the most frequent limitation of their use with scintillation chambers. An experimental arrangement containing four tubes and intermediate lenses was used to view such a filament scintillation chamber. The overall gain of the system was about 3×10^5. The tubes could be gated by two scintillation counters in coincidence, arranged so that cosmic ray tracks passing vertically through the chamber could be photographed, or by a photomultiplier viewing the chamber directly. A photograph is reproduced showing a track due to a particle of two to three times minimum ionization. R.E.Meads

539.1.07

9902. RESPONSE OF NaI(Tl) TO SODIUM NUCLEI.
E.N.Shipley, G.E.Owen and L.Madansky.
Rev. sci. Instrum., Vol. 30, No. 7, 604-5 (July, 1959).

A NaI:Tl scintillator was bombarded with d—d neutrons, and the pulses due to the 440 keV γ-rays and Na recoils, from inelastic n-scattering, were observed in delayed coincidence with the scattered n-pulses in a stilbene scintillator. The energy E_p of the observed photopeak in the pulse amplitude spectrum = E_γ (the γ-ray energy) + μE_r where E_r is the recoil energy and μ the relative response of NaI:Tl to Na nuclei compared with electrons. It is observed that $\mu = 0.340 \pm 0.002$, and that the response is linear, within the experimental error, for $E_r = 0\text{-}540$ keV. J.B.Birks

539.1.07 : 535.376

ESTIMATION OF THE EFFICIENCY OF A NaI WELL-TYPE SCINTILLATOR. See Abstr. 9490

539.1.07 : 537.533

PRODUCTION OF PHOTO[ELECTRON]-MULTIPLIERS AND THEIR ELEMENTARY PARAMETERS. See Abstr. 9695

539.1.07

9903. CRYSTAL COUNTERS OF CADMIUM SULPHIDE WITH A HIGH-FREQUENCY ELECTRIC FIELD. M.Borisov and M.Marinov.
C.R. Acad. Bulg. Sci., Vol. 11, No. 3, 169-72 (May-June, 1958). In Russian.

A single crystal of CdS, not more than 0.1 mm thick, was gold-plated each side and to it was applied a high-frequency potential of about 1 Mc/s from a valve oscillator. Polarization effects were thus eliminated and, since the pulse length was greater than the oscillator period, the efficiency of detection did not vary with the phase of the latter. Alpha, beta and gamma radiations could be detected, a ThC α-particle giving a pulse of about 100 mV. A histogram is given showing the clear resolution of the α-particles from ThC and ThC' (6.04 and 8.77 MeV). The pulse height varied linearly with particle energy. J.H.Fremlin

539.1.07

9904. HOLE CONDUCTIVITY IN PULSE PROCESSES IN CdS CRYSTAL COUNTERS. M.Marinov.
C.R.Acad. Bulg. Sci., Vol. 11, No. 5, 371-4 (Sept.-Oct., 1958). In French.

Preliminary results indicate the presence of hole as well as electron conductivity. Oscillograms are given showing the dependence of the pulse shape on the position of the point of ionization with respect to the anode and cathode. T.P.Brody

539.1.07

9905. ABSOLUTE THERMAL NEUTRON FLUX MEASUREMENTS WITH A 4π COUNTER, AND [ACTIVATED] INDIUM FOILS.
V.Maxia and M.A.Rollier.
Ricerca sci., Vol. 29, No. 6, 1199-208 (June, 1959). In Italian.

Reports some measurements in a subcritical assembly. This method does not need calibration with the neutron flux from a standard source and may be used in any reactor.

539.1.07

9906. A SIMPLE DEVICE FOR PERSONNEL MONITORING OF AN ACCIDENTAL NUCLEAR REACTION.
H.F.Henry, J.C.Bailey and R.C.Rohr.
Nuclear Sci. Engng, Vol. 5, No. 5, 285-90 (May, 1959).

The radioactive In^{116} produced by the $In^{115}(n,\gamma)In^{116}$ reaction has been utilized in a simple personnel monitoring device as a method for estimating the total radiation dosage received in the event of a possible accidental nuclear reaction. A 1 g indium foil is placed in a standard plastic security badge; after a suspected exposure to an accidental burst, this foil is monitored by a β-γ survey meter, and the reading obtained used to determine the estimated dosage. A time-after-exposure correction factor is also used. For calibration of indium foil, an exposure to a light-water moderated critical reactor of highly enriched uranyl fluoride was evaluated and the results are indicated briefly. An instantaneous exposure of about 60 mrad is detectable immediately after an exposure even with the unsplit badges and one of about 120 mrad is detectable an hour after the occurrence.

539.1.07

9907. INDUSTRIAL SPECIMENS OF DETECTORS FOR THERMAL AND FAST NEUTRONS. V.S.Filonov.
Izv. Akad Nauk SSSR, ser. fiz., Vol. 22, No. 1, 94-6 (1958). In Russian. English summary: PB 141041T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Describes the properties of a Hornyak button dosimeter suitable for fast and (when boron-loaded) thermal neutrons.
A.E.I. Research Laboratory

539.1.07 : 539.21

RADIATION COLORATION IN GLASS — POSSIBLE APPLICATION IN DOSIMETRY. See Abstr. 8863

539.1.07

9908. THE SIMULTANEOUS MEASUREMENTS OF PARTICLE MOMENTUM AND IONIZATION IN A CLOUD CHAMBER.
B.Brunelli.
Ricerca sci., Vol. 29, No. 5, 930-45 (May, 1959). In Italian.

Describes the difficulties arising in the construction of a cloud chamber for these measurements, and studies the limitations inherent in the accuracies obtainable. The best conditions to ensure maximum accuracy are discussed, and a comparison is made with the best cloud chambers existing.

539.1.07

9909. THE BUBBLE CHAMBER AND ITS APPLICATIONS TO THE PHYSICS OF THE ELEMENTARY PARTICLES. K.Gottstein.
Naturwissenschaften, Vol. 46, No. 3, 97-102 (1959). In German.

Short review article on bubble chamber technique (theory and operation) illustrated by a selection of photographs of events involving strange particle production, obtained with the 10 in. Berkeley liquid hydrogen bubble chamber. G.Martelli

539.1.07

9910. REMARKS ABOUT GAS BUBBLE CHAMBER SENSITIVITY.
P.E.Argan, A.Gigli, E.Picasso and G.Tomasini.
Nuovo Cimento, Vol. 10, No. 1, 177-81 (Oct. 1, 1958).

Some ideas on the operation of gas bubble chambers are discussed and the possibility of showing the relativistic increase in energy loss of electrons with increase of energy is suggested as giving an index of merit for the sensitivity. The means of arriving at the correct thermodynamic conditions for maximum sensitivity are considered in the light of the authors' results and those of Blinov, Krestikov and Lomanov (Abstr. 3402 of 1957). It is shown that the results obtained by the latter with a liquid propane bubble chamber can be explained by the authors' theory if the chamber, in reality, contained about 2% of dissolved gas. T.O.Jeffries

539.1.07

9911. HIGH DENSITY AND LARGE ATOMIC NUMBER SYSTEMS FOR GAS BUBBLE CHAMBERS.
P.E.Argan, M.Conte, A.Gigli, E.Picasso and L.Gonella.
Nuovo Cimento, Vol. 10, No. 1, 182-5 (Oct. 1, 1958).

The advantages of gas bubble chambers for the attainment of sensitive systems with high density and large atomic number are discussed. The possibility of room temperature operation is particularly advantageous where corrosive liquids must be used and the s bility of operation over a wide range of operating conditions makes t system very attractive. The liquids which may be chosen are le s restricted than with a liquid bubble chamber as the extra param ters of gas type and pressure are available to enable sensitive s tems to be obtained. Results with an $SnCl_4$ chamber are presented.

T.O.Jeffries

539.1.07

9 2. OPERATION OF A BUBBLE CHAMBER FILLED WITH " GH Z" MIXTURES.
I Bertanza, P.Franzini, I.Mannelli and V.Silvestrini.
N ovo Cimento, Vol. 10, No. 2, 403-4 (Oct. 16, 1958).

The conditions of successful operation of gas bubble chambers c taining methyl iodide—ethane and methyl iodide—carbon dioxide s tems with and without small quantities of propane are reported. T o photographs of tracks of Compton electrons from the γ-rays of a adioactive source are reproduced.

T.O.Jeffries

539.1.07

9 3. ON IONIZATION MEASUREMENTS IN A HYDROGEN B BBLE CHAMBER. I.Derado and N.Schmitz.
N ovo Cimento, Vol.11, No. 6, 887-9 (March, 1959).

Bubble densities of pions and protons in photographs of a h rogen chamber are found to be equal. However, the δ-ray dens y for momenta less than 650 MeV/c is considerably greater for p tons than for pions and enables particle discrimination. Graphs a presented.

T.O.Jeffries

539.1.07

9 4. DEMONSTRATION OF THE TWOFOLD STRUCTURE OF T E TRACKS OF HEAVY IONS AND ITS APPLICATION TO THEIR D CRIMINATION. C.Gegauff, J.P.Lonchamp and P.Cüer.
C R. Acad. Sci. (Paris), Vol. 247, No. 22, 1983-5 (Dec. 1, 1958).
I French.

Ilford K emulsions were used to show the difference between p mary and secondary (δ-ray) ionization of heavy ions. The lengths o he continuous primary sections of the tracks of ions with $Z > 6$ c ld provide a new criterion for discrimination.

E.J.Burge

539.1.07

9 5. ON FIXING SOLUTIONS FOR NUCLEAR EMULSIONS.
D eughebaert and J.Heughebaert.
N ovo Cimento, Vol. 12, No. 6, 623-6 (June 16, 1959).

Clearing time, swelling, transparency and corrosion of Ilford K emulsion in fixing solutions of 3 different compositions have been st died, and a solution chosen which, while reducing the clearing ti e and the danger of corrosion, does not increase the opacity, nor, to any appreciable extent, the swelling of the emulsion.

539.1.07

9 6. EXPERIMENTAL STUDY OF A FAST COINCIDENCE C CUIT FOR LOW ENERGIES.
S orodetzky, R.Manquenouille, R.Richert and J.Lefort.
C R. Acad. Sci. (Paris), Vol. 248, No. 15, 2202-4 (April 13, 1959).
I French.

539.1.07

9 7. TRIGGER FEEDING OF A COUPLE OF GEIGER—MÜLLER C UNTERS. L.Mitrani and B.Betev.
C .Acad. Bulg. Sci., Vol. 11, No. 5, 363-6 (Sept.-Oct., 1958).

Describes a method of binding two counters by means of a res ation relay with two stable states. The resulting reduction of the d d-time (lower than in the case of two parallel counters), suggests t use of this method for fast counting.

J.M.Zarzycki

539.1.07

9 8. MODIFICATION OF THE CHARGING EQUIPMENT FOR A P RSONAL DOSIMETER. V.B.Stradomskii.
P bory i Tekh. Eksper., 1959, No. 1, 134 (Jan.-Feb.). In Russian.

Short description of a half-wave Se rectifier for charging a d imeter (DK-0.2) from 127 or 220 V a.c. supply.

P.Collins

539.1.07 : 539.163

HALF-LIFE MEASUREMENTS OF Ta^{181m} AND Y^{88m}. See A str. 8530

539.1.07

9 9. SECTORED BETA-SPECTROMETER WITH DOUBLE F CUSING. D.L.Kaminskii and M.G.Kaganskii.
P bory i Tekh. eksper., 1959, No. 1, 32-6 (Jan.-Feb.). In Russian.

The spectrometer described employs a non-uniform axially-s metrical vertical magnetic field to focus particles leaving the source over a range of 30° horizontally and 14° vertically. The source is placed within the magnetic field and the detector outside it, but within the vacuum chamber. Total mean beam deflection is about 200°. The magnet is made in sections, adjustment of which makes it possible to attain the exact form of field desired. The magnet can be stabilized to 0.01%. The solid angle accepted is determined by a diaphragm; when this is 0.9% of 4π, the half-width of a conversion line is 1.3%, and for a solid angle 0.3% of 4π the half-width is 0.36%.

J.H.Fremlin

539.1.07

9920. SINGLE CRYSTAL AUTOMATIC NEUTRON DIFFRACTOMETER. E.Prince and S.C.Abrahams.
Rev. sci. Instrum., Vol. 30, No. 7, 581-5 (July, 1959).

An automatic neutron diffraction system for measuring the intensities of all accessible reflections in a zone is described. Crystal and counter setting information is supplied to the instrument on five-channel punched paper tape. The angular settings are measured by means of analogue-to-digital converters. All angle information is printed out digitally, together with the diffraction intensity information.

ELEMENTARY PARTICLES

539.12 : 539.165

9921. POSSIBLE ASYMMETRY OF PARTICLES AND ANTI-PARTICLES IN WEAK INTERACTIONS.
A.A.Ansel'm and V.M.Shekhter.
Zh. eksper. teor. Fiz., Vol. 34, No. 3, 761-2 (March, 1958).
In Russian. English translation in: Soviet Physics—JETP (New York), Vol. 34(7), No. 3, 523-4 (Sept., 1959).

Discusses the difficult situation that would have arisen if β^- and β^+ decays had been found to have different properties.

J.C.Taylor

539.12

9922. ON THE SCATTERING OF A CHARGED PARTICLE IN HYDROGEN. M.Demeur and P.Janssens.
C.R. Acad. Sci. (Paris), Vol. 248, No. 8, 1132-5 (Feb. 23, 1959).
In French.

Theoretical. Presents curves of cross-section and energy loss calculated in the Born approximation using various forms of central field to represent H and H_2.

J.Hawgood

539.12

9923. THEORY OF DIFFUSE REFLECTION AND TRANSMISSION IN THE CASE OF ELASTIC MULTIPLE SCATTERING [OF PARTICLES]. A.Goertz.
Z. Phys., Vol. 155, No. 3, 263-74 (1959). In German.

In order to determine the diffuse reflectivity and transmittivity, it is not necessary to solve the complete differentio-integral equation of multiple scattering. It can be shown that the problem reduces to solving a set of two simultaneous differential equations of the first order, provided that the amount of sideward scattering can be neglected. The solutions of these equations furnish all the data required, if the mechanism of single scattering is known.

539.12 : 539.17

THRESHOLD BEHAVIOUR OF CROSS-SECTIONS OF CHARGED PARTICLES. See Abstr. 8562

539.12

9924. TRIDENTS, μ PAIRS, AND QUANTUM ELECTRODYNAMICS AT SMALL DISTANCES. J.D.Bjorken and S.D.Drell.
Phys. Rev., Vol. 114, No. 5, 1368-74 (June 1, 1959).

Four experiments are proposed and discussed as tests of quantum electrodynamics, as applied to photons, electrons, and μ-mesons at distances $< 10^{-13}$ cm. These are: (1) electron—positron pair production by electrons in hydrogen (tridents); (2) wide-angle photoproduction of μ-meson pairs in hydrogen with detection of one final meson; (3) wide-angle photoproduction of μ-meson pairs in hydrogen with detection of both final mesons in coincidence; (4) μ-meson pair-production by electrons in hydrogen. Taken together with wide-angle photoproduction of electron—positron pairs, which was discussed earlier, these experiments will extend the knowledge of electron, photon, and μ-meson "size" to distances $\sim 0.3 \times 10^{-13}$ cm. They are all feasible for the Stanford linear accelerator operating in the 500 MeV-1 BeV energy range.

539.12 : 539.17

SPECTRUM OF THIN TARGET BREMSSTRAHLUNG BOUNDED BY A FORWARD CIRCULAR CONE. See Abstr. 8613

539.12

9925. CHARACTERISTICS OF THE ELECTROMAGNETIC CASCADES IN PHOTOEMULSIONS WHEN THE INFLUENCE OF THE MEDIUM ON THE RADIATION PROCESSES IS TAKEN INTO ACCOUNT. A.A.Varfolomeev, D.I.Golenko and I.A.Svetlolobov.
Dokl. Akad. Nauk SSSR, Vol. 122, No. 5, 785-7 (Oct. 11, 1958).
In Russian.

Results of the Monte Carlo method for electromagnetic cascades up to a distance of 1.5 radiation length are given for generating electrons with initial energies of 10^{11} and 10^{12} eV. In the calculations two alternative methods have been followed: (a) the Bethe and Heitler formula for the elementary process has been used; (b) the influence of the medium on the radiation process has been calculated according to the formulae given by Migdal (Abstr. 462 of 1957). The medium considered in both cases is nuclear emulsion. Results are shown in histograms. G.Martelli

539.12

9926. AN ILLUSTRATION OF INELASTIC SCATTERING OF γ-RAYS BY BOUND ATOMIC ELECTRONS.
L.Goldzahl and J.Banaigs.
J. Phys. Radium, Vol. 19, No. 7, 678-80 (July, 1958). In French.

Approximate calculation has shown that the cross-section for inelastic scattering of γ-rays by bound electrons, in which the incident γ-ray energy and momentum are shared between the electron, the atom and the scattered γ-ray, is not negligible compared to that for inelastic scattering in the region of 1 MeV. 1.12 MeV γ-rays from Zn^{65} were scattered through 50° in lead and the energy of the scattered radiation measured using a sodium iodide crystal and pulse-height analyser. The intensity of inelastically scattered radiation of energy between 0.95 MeV and 1.12 MeV was approximately equal to that of elastically scattered radiation at 1.12 MeV. A.E.I. Research Laboratory

539.12

9927. COMPTON SCATTERING OF LONGITUDINALLY POLARIZED PHOTONS ON ELECTRONS WITH ORIENTED SPIN.
A.A.Sokolov and B.A.Lysov.
Zh. eksper. teor. Fiz., Vol. 34, No. 5, 1351-4 (1958). In Russian.
English summary: PB 141052T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The Klein—Nishina formula is generalized to the case of a given initial spin orientation of the electron, and the circular polarization of the scattered radiation is computed. An expression for the cross-section of two-photon annihilation of longitudinally polarized positrons on electrons at rest with a given spin direction suggests a possible experimental method of determining the degree of longitudinal polarization of positrons.

A.E.I. Research Laboratory

539.12 : 537.54

9928. CALORIMETRIC MEASUREMENTS OF GAMMA-RAY ENERGY FLUX FROM A SYNCHROTRON. S.P.Kruglov.
Zh. tekh. Fiz., Vol. 28, No. 10, 2310-23 (1958). In Russian.

For previous work see Abstr. 7232 (1958). The construction and the operation of a calorimeter suitable for measurements of the energy flux of gamma-rays with energy up to 500 MeV is described. The temperature changes were measured by thermally sensitive resistors. The instrument was calibrated using heating elements placed within absorbing cylinders of lead. The construction of such cylinders, affording good thermal contact with the heaters, is described. The maximum errors in the calibration do not exceed 1%. Results of measurements carried out at three different maximum energies are given. The results obtained with absorbing cylinders of two different sizes coincide within the experimental limits.

G.Martelli

539.12

9929. FORM FACTOR INFLUENCE ON PROCESSES OF BREMSSTRAHLUNG AND PAIR PRODUCTION ON PROTONS.
P.S.Izaev and I.S.Zlatev.
Nuovo Cimento, Vol. 13, No. 1, 1-11 (July 1, 1959).

The differential cross-sections of the processes of electron bremsstrahlung and pair production by γ-quanta on protons in presence of the form factor were calculated. This calculation was made in the lowest order of perturbation theory. The formula of the differential bremsstrahlung cross-section was integrated over all angles, except the angle between the direction of the incident electron and that of the emitted photon. A comparison of the differential and integral bremsstrahlung cross-sections with the corresponding Bethe—Heitler formulae was made.

539.12

9930. PHOTON AND ELECTRON POLARIZATION IN HIGH-ENERGY BREMSSTRAHLUNG AND PAIR PRODUCTION WITH SCREENING. H.Olsen and L.C.Maximon.
Phys. Rev., Vol. 114, No. 3, 887-904 (May 1, 1959).

The matrix element for bremsstrahlung and pair production is written in a particularly simple form which reduces to the well-known matrix element for nonrelativistic energies, in terms of a vector which is closely related to the nonrelativistic current density vector. The cross-section for high-energy bremsstrahlung and pair production involving arbitrarily polarized photons and electrons has been calculated. The Coulomb and screening effects are taken into account exactly. It is found that the screening and Coulomb corrections to the polarization-dependent part of the cross-section are analytically of the same form and numerically of the same magnitude as the corrections to the polarization-independent part of the cross-section found earlier. The cross-section is also given for bremsstrahlung summed over spin and polarization directions and integrated over the direction of motion of the final particle, i.e., the angular distribution of the radiation, which has a very simple form. Formulae are given for the linear and circular polarization of bremsstrahlung from arbitrarily polarized electrons and for the spi polarization of pairs from arbitrarily polarized photons. The circular polarization of bremsstrahlung from longitudinally polarized electrons is complete at the upper end of the spectrum and is much larger than from transversely polarized electrons throughout the spectrum. In the same way, circularly polarized photons produce longitudinally polarized electron—positron pairs, the probability of producing transversely polarized pair particles being, in general, much smaller. The faster one of the pair particles is always polarized in the same sense as the photon. On the other hand, the linear polarization of bremsstrahlung is smallest at the upper end of the spectrum and increases with decreasing photon energy. It is independent of the spin of the initial electron if one sums over the spin of the final particle. The circular polarization of the emitted photons is to a high degree independent of screening and Coulomb corrections, at the high energies considered here. The linear polarization is, however, significantly dependent on these corrections. Similar conclusions hold for pair production from circularly and linearly polarized photons, respectively. Finally, the electron spin photon polarization correlation for bremsstrahlung and pair production is discussed. The depolarization, because of bremsstrahlung, of polarized electrons passing through matter is calculated and is appreciable over a radiation length. It is greater for a transversel polarized electron than for a longitudinally polarized electron.

539.1

9931. MEASUREMENT OF BREMSSTRAHLUNG SPECTRA WIT SODIUM IODIDE SCINTILLATION CRYSTAL.
M.Kimura, N.Mutsuro, Y.Ohnuki, K.Shoda, M.Sugawara, T.Tohei and H.Yuta.
J. Phys. Soc. Japan, Vol. 14, No. 4, 387-96 (April, 1959).

The bremsstrahlung spectra of the 8.5 MeV electrons for the forward direction were measured with a scintillation spectrometer of a sodium iodide crystal 4 in. in diameter and 4 in. in length. B Ni and Pt of several thickness were used as the targets. The measured spectra were compared with semi-empirical calculations. Th calculation was based upon the response function for the NaI cryst which was constructed according to the method developed by the N.B.S. group and also to the actual response curve for the monochrom gammas of 1.12 and 6.14 MeV, instead of using the Monte Carlo method which had generally been used in former researches. The agreement is good if Schiff's formula for the intrinsic bremsstrahlung spectra is used.

539

9932. CHERENKOV RADIATION EMITTED BY DIPOLE MOMENTS. V.L.Ginzburg and V.Ya.Éidman.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1508-12 (1958).
In Russian.

Considers the radiation emitted by electric and magnetic dipoles moving in a continuous medium, and also in a channel or slit.

539.12

3. CHERENKOV RADIATION OF AN ELECTRON MOVING A MEDIUM WITH SPATIAL DISPERSION.

V .Agranovich, V.E.Pafomov and A.A.Rukhadze.

Z eksper. teor. Fiz., Vol. 36, No. 1, 238-43 (1959). In Russian.

Vavilov–Cherenkov radiation in an isotropic gyrotropic medium is xamined. The angular distribution of the radiation intensity and exit of the radiation through the boundary of the medium are dis- sed.

539.12

4. ENERGY-LOSSES OF PARTICLES IN CONNECTION WITH T E EXCITATION OF LONGITUDINAL WAVES. B.A.Lȳsov.

Z eksper. teor. Fiz., Vol. 36, No. 1, 321-2 (1959). In Russian.

The theory of the Cherenkov effect is applied to the case when charged particle emits longitudinal electromagnetic waves. An ression is obtained for the energy emitted per unit length of path.
P.Roman

539.12

5. SPIN OF AN ELECTRON FROM FIVE-DIMENSIONAL VE EQUATION. C.C.Banerjee.

an J. Phys., Vol. 32, No. 4, 179-82 (April, 1958).

The author attempts a general solution of the five-dimensional logue of the Klein–Gordon equation and finds that an intrinsic ular momentum of the electron similar to the spin appears as a sequence of the solution.

539.12

6. QUANTAL CORRECTIONS TO THE RADIATION OF A LATIVISTIC RIGID ROTATOR. L.V.Ioganson.

Z eksper. teor. Fiz., Vol. 36, No. 1, 313-14 (1959). In Russian.

It is shown that by neglecting completely the excitation of the tron-oscillations and considering the electron as an absolutely d rotator, one obtains practically the same results for the ntal corrections to the radiation of the electron in a synchrotron, y the usual methods of calculation.
P.Roman

539.12

7. DEPOLARIZATION OF β-PARTICLES DUE TO TTERING IN RADIOACTIVE PREPARATIONS [SOURCES].

ühlschlegel.

Phys., Vol. 155, No. 1, 69-76 (1959). In German.

The depolarization is estimated, taking into account multiple tering and (with some approximations) single scattering for er angles. It is found that the depolarization amounts to a few cent for usual sources.

539.12

8. MEASUREMENTS ON THE ANGULAR DEPENDENCE OF TT SCATTERING ASYMMETRY. H.Bienlein, G.Felsner, leischmann, K.Güthner, H.v.Issendorff and H.Wegener.

Phys., Vol. 155, No. 1, 101-8 (1959). In German.

The angular distribution of the asymmetry is measured for o-energetic and transversely polarized electrons of 155 keV and cattering angles from 40° to 150°. The angular dependence sured agrees with the calculations of Sherman (Abstr. 457 of 9). The absolute value of the asymmetry is obtained with a stical error of about 10%. A possible influence of screening ithin this limit.

539.12

9. SINGLE SCATTERING OF MEDIUM FAST ELECTRONS ON VY ATOMIC NUCLEI. J.Kessler.

Phys., Vol. 155, No. 3, 350-67 (1959). In German.

The Mott theory of the Coulomb-scattering of electrons and e experimental results (for example, those of Kinzinger and e) do not agree. Therefore a new experimental method was to investigate this problem. The 150 keV electrons were not tered by foils, but by gases of low pressure; to get enough tering events in spite of the small number of scattering centres nnular counter was used, which integrated with respect to the uth angle. Scattering by a gaseous target had the important ntage that corrections for multiple scattering were negligible. main experimental difficulty was the complete suppression of electrons backscattered from the chamber walls. Relative s-sections were determined for 60, 90, 120 and 135 degrees he atomic numbers 36, 54, and 80. The data are in agreement the Mott theory within the experimental error of ±5%.

539.12 : 539.165

9940. LONGITUDINAL POLARIZATION OF POSITRONS FROM THE DECAY OF O^{14}.

J.B.Gerhart, F.H.Schmidt, H.Bichsel and J.C.Hopkins.

Phys. Rev., Vol. 114, No. 4, 1095-100 (May 15, 1959).

The longitudinal polarization of 1.2 MeV positrons from the well-known $0+ \rightarrow 0+$ transition of 72 second O^{14} was measured. Positrons, selected by a magnetic spectrometer, were allowed to annihilate in a plastic scintillator. Annihilation-in-flight photons were analysed for circular polarization by Compton scattering from magnetized iron. The positrons were found to have right-handed longitudinal polarization $(+0.73 \pm 0.17)v/c$.

539.12

9941. PAIR PRODUCTION IN THE FIELD OF THE ELECTRON.

J.Moffatt and G.C.Weeks.

Proc. Phys. Soc., Vol. 73, Pt 1, 114-16 (Jan., 1959).

Reports measurements of the total absorption cross-section of 42.5 and 68.5 MeV photons in hydrogen, supplementing an earlier measurement at 94 MeV (Abstr. 1822 of 1958). This quantity should be close to the pair production cross-section for a free electron; the results are consistent with theoretical upper and lower bounds for the latter.
R.J.N.Phillips

539.12

9942. PAIR-PRODUCTION BY CIRCULARLY POLARIZED PHOTONS. I.M.Nadzhafov.

Zh. eksper. teor. Fiz., Vol. 36, No. 1, 337-9 (1959). In Russian.

The cross-section for this process, in the field of a point nucleus, is given in the general case, for all important angles and energies.
P.K.Kabir

539.12

9943. WAVE FUNCTIONS AND POLARIZATION STATES OF A TWO-PHOTON SYSTEM. Y.Wang.

Scientia Sinica, Vol. 8, No. 2, 172-82 (Feb., 1959).

The relations between the number of states and polarization, and the parity and angular momentum of a two-photon system are studied in the cases of the two-photon decay of the neutral meson and the annihilation of positronium. Explicit wave-functions for such a system are calculated and the results discussed in the light of previous work.
S.J.St-Lorant

539.12 : 530.145

9944. ON THE STRUCTURE OF NUCLEONS AND HYPERONS. N.St.Kalitsin.

Izv. Bulg. Akad. Nauk., Vol. 6, 13-19 (1956; publ. 1957). In Bulgarian with summary ($2\frac{1}{2}$ pp.) in German.

A composite baryon model is proposed and investigated. The nucleon is supposed to be composed of a very heavy "nuclonid" with spin and isospin zero and even parity, and of an "electronid", having a mass of the order of the proton mass, spin and isospin $\frac{1}{2}$, and charge zero or e. Both are supposed to have a large "K-mesonic charge".
P.Roman

539.12

9945. THE STRUCTURE OF NUCLEONS AND HYPERONS. N.S.Kalitsin.

C.R. Acad. Bulg. Sci., Vol. 10, No. 1, 1-4 (Jan-Feb., 1957). In German.

A very qualitative speculation concerning a possible compound model of the nucleon is made along the lines of the Heitler–London treatment of the hydrogen molecule. No evidence in support of the proposal is given and no consequences are deduced.
S.J.St-Lorant

539.12

9946. NUCLEON STRUCTURE AND PION–PION INTERACTION.

D.I.Blohinčev, V.S.Barašenkov and B.M.Barbašov.

Nuovo Cimento, Vol. 12, No. 6, 602-10 (June 16, 1959).

The density of a meson cloud in a nucleon is calculated on the basis of the extended source theory. The nucleon periphery is determined as a region of the applicability of the one-meson state. The pion–pion interaction cross-section is estimated. The coefficient of pion absorption in a nucleon found experimentally is compared with that calculated by the optical model.

539.12

9947. LIMITATIONS ON THE NUCLEON FORM FACTORS DUE TO CAUSALITY REQUIREMENTS. B.Bosco and V.De Alfaro.

Nuovo Cimento, Vol. 13, No. 1, 154-8 (July 1, 1959).

Starting from the spectral representation of the form factors, the authors investigate what kind of functions have to be used in order to represent the nucleon charge and magnetic moment distribution.

539.12 : 530.145

A SYMMETRICAL FORM OF THE NUCLEON EQUATION. See Abstr. 9221

539.12

9948. NUCLEON—NUCLEON CROSS-SECTIONS AT HIGH ENERGIES.

R.B.Begzhanov.

Zh. eksper. teor. Fiz., Vol. 34, No. 3, 775-6 (March, 1958). In Russian. English translation in : Soviet Physics—JETP (New York), Vol. 34(7), No. 3, 534-5 (Sept., 1958).

From proton—nucleus data, the effective total nucleon—nucleon cross-section between 0.9 and 34 BeV is calculated to be 32 ± 3 mb.

R.J.N.Phillips

539.12 : 539.17

ENERGY DEPENDENCE OF THE ANISOTROPY OF NUCLEON—NUCLEON INTERACTIONS. See Abstr. 8564

539.12

9949. EFFECTIVE RANGE THEORY IN NUCLEON—ALPHA SCATTERING.

G.Pisent and C.Villi.

Nuovo Cimento, Vol. 11, No. 2, 300-306 (Jan. 16, 1959).

An effective range expansion is used to analyse nucleon—alpha scattering. Linearity with energy is found from experiment up to 7 MeV for the S state and up to 4 MeV for the $P_{3/2}$ state. Effective ranges and scattering lengths are given for these states in n—α and p—α scattering. Linearity is also consistent with the data for the $P_{1/2}$ state but the data is not adequate for the parameters to be evaluated. The behaviour is such as to exclude the normal P doublet. It is shown that the polarization measurements in n—α scattering of Levintov et al. (Abstr. 6623 of 1957) are not inconsistent with the analysis. More accurate data are required particularly if D wave contributions are to be considered.

A.Ashmore

539.12

9950. THE NON-UNIQUENESS OF PHASES IN THE SCATTERING OF NUCLEONS BY NUCLEONS.

L.G.Zastavenko, R.M.Rȳndin and Chzhou Guan-chzhao.

Zh. eksper. teor. Fiz., Vol. 34, No. 2, 526-7 (1958). In Russian. English summary: PB 141052T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Three transformations of the nucleon—nucleon scattering matrix, which leave the unpolarized cross-section unchanged, are given and discussed. [This work is also contained in an English publication by the same authors, Abstr. 3739 of 1959].

R.J.N.Phillips

539.12

9951. RESULTS ON ANTIPROTON—PROTON ELASTIC SCATTERING.

G.Baroni, G.Bellettini, C.Castagnoli, M.Ferro-Luzzi and A.Manfredini.

Nuovo Cimento, Vol. 12, No. 6, 564-70 (June 16, 1959).

Fifteen antiproton—proton elastic scatterings are described: the angular distribution and the cross-section $\sigma_{el} = (65.7 \pm 17)$mb are obtained. By averaging these results with those obtained by other laboratories under similar conditions, it is found that $\sigma_{el} = (70.9 \pm 12.7)$ mb. Both angular distribution and cross-section are in agreement with the predictions of Ball—Chew's theory. Four events were used for an accurate determination of the antiproton mass: $m_{\bar{p}} = (0.998 \pm 0.015)$ proton masses.

539.12

9952. MODIFIED ANALYSIS OF NUCLEON—NUCLEON SCATTERING. I. THEORY AND p—p SCATTERING AT 310 MeV.

P.Cziffra, M.H.MacGregor, M.J.Moravcsik and H.P.Stapp.

Phys. Rev., Vol. 114, No. 3, 880-6 (May 1, 1959).

A modified method of analysing nucleon—nucleon scattering is discussed and applied to proton—proton scattering experiments at 310 MeV. The modified scheme is based on an explicit inclusion in all higher angular-momentum states of the terms contributed by the one-pion exchange process. This procedure is suggested by Chew's conjecture that the singularities of the scattering amplitude in the cos θ plane (θ being the scattering angle in the centre-of-mass system) that are closest to the physical region are due to the one-pion exchange process and are given by the Born approximation. Or, alternatively, in terms of ranges, the one-pion exchange contrib ution has the longest range of the forces contributing to the nucleon nucleon interaction and hence should be primarily responsible for the contributions to the scattering amplitude in the high angular-momentum states. Since the only parameter in the Born approxima tion is the pion—nucleon coupling constant, the modified scheme ca also provide a determination of this coupling constant. The applica tion of the modified scheme to p—p scattering at 310 MeV indicates that the first two of the five best solutions of the conventional phase shift analysis are more satisfactory that the others for two reasons Firstly, their goodness-of-fit parameters improve markedly when t higher angular-momentum contributions are added, whereas those o the others remain essentially unchanged. Secondly, as a function of the coupling constant, the goodness-of-fit parameters of the first tw solutions show minima close to the accepted value of the coupling constant.

539.1

9953. DISPERSION RELATIONS FOR P—N SCATTERING.

J.Hamilton.

Phys. Rev., Vol. 114, No. 4, 1170-8 (May 15, 1959).

The application of dispersion relations to low-energy p—n scattering is examined. It is shown that Khuri's dispersion relatio can be extended to include tensor forces, but serious difficulties appear on attempting to include exchange forces. The application o the relativistic field theory dispersion relations to low-energy scattering is made by using the effective range formula. The spuriou poles of the S-matrix are related to the two- and three-pion terms in the unphysical region contribution for forward scattering.

539.1

9954. ELASTIC PROTON—DEUTERON SCATTERING AT 450 MeV.

A.V.Crewe, B.Ledley, E.Lillethun, S.Marcowitz and L.G.Pondrom.

Phys. Rev., Vol. 114, No. 5, 1361-5 (June 1, 1959).

The elastic scattering cross-section for 450 MeV protons by deuterons has been measured for proton centre-of-mass scattering angles from 16.45° to 127 °. The scattered protons (or recoil deuterons) were analysed by a magnet and detected by a scintillatio counter telescope. The cross-sections have been normalized by using published p—p cross-sections. The sticking factor has been calculated for two deuteron potentials using the impulse approximation. This analysis indicates that there may be destructive inter ference between the n—p and p—p scattering in the deuteron at this energy.

539.1

9955. ANTIPROTON ANNIHILATION IN NUCLEAR EMULSION.

A.H.Armstrong and G.M.Frye, Jr.

Nuovo Cimento, Vol. 13, No. 1, 77-84 (July 1, 1959).

Sixteen antiproton stars observed in an emulsion stack expose at the Berkeley Bevatron to a beam of negative particles of momentum 700 MeV/c have been analysed in detail. It is found tha in the "elementary" antiproton—nucleon annihilation an average of (4.7 ± 0.6) mesons are produced, each with an average total energ of (348 ± 28) MeV. No strange particles were observed as annihila tion products.

539.12 : 539.1

9956. THE TRANSMISSION OF NEUTRONS IN MULTILAYERED SLAB GEOMETRY.

H.S.Wilf.

Nuclear Sci. Engng, Vol. 5, No. 5, 306-19 (May, 1959).

The use of the method of discrete ordinates as a numerical tool in reactor calculations is described. A scheme for the numer cal integration of the discrete ordinate equations is developed, and the results compared with known exact solutions. The problem of reflection and transmission of neutron beams in stratified slab geometry is considered from the point of view of the method of dis crete ordinates. A matrix formalism is derived which permits th calculation of transmitted and reflected distributions if the inciden beam is given. Asymptotic expressions for the relevant matrices are given, and comparison is made with the work of Chandrasekha Tables of the matrix elements in the P_7 approximation are presen

539.12 : 539

9957. THE NUMBER OF ELASTIC COLLISIONS IN A FINITE LETHARGY INTERVAL.

W.C.DeMarcus.

Nuclear Sci. Engng, Vol. 5, No. 5, 336-7 (May, 1959).

An integral equation is derived for the function giving the average number of collisions required to thermalize neutrons by stic collisions with nuclei of relative mass M. An asymptotic ution is obtained which corrects the customary result by between nd 1 collision (depending on M). Numerical results for small argy increments are presented for the cases M = 2 and M = 235.

539.12 : 539.17

SLOWING DOWN TIME OF NEUTRONS IN HEAVY DERATORS. See Abstr. 8654

539.12 : 539.14

MULTIPLE NEUTRON CAPTURE IN THE MIKE FUSION PLOSION. See Abstr. 8513

539.12

58. POLARIZABILITY OF THE NEUTRON. R.M.Thaler.
ys. Rev., Vol. 114, No. 3, 827-9 (May 1, 1959).

Experiments on scattering of low-energy neutrons by heavy ments may give information concerning the electric polarizability the neutron. The relation of the electric polarizability to the low- ergy neutron scattering data is developed. One pertinent experi- nt is discussed and from this an upper bound on the polarizability obtained. This upper bound to the polarizability α is an order of gnitude larger than the meson-theoretic estimate of α. If the lue of α is as small as is predicted by meson theory, or by an alysis of the pion photoproduction data, then it is unlikely to be served in neutron scattering experiments of the presently achiev- le accuracy.

539.12

59. ELECTRIC POLARIZABILITY OF THE NEUTRON.
Breit and M.L.Rustgi.
ys. Rev., Vol. 114, No. 3, 830-7 (May 1, 1959).

In connection with a proposed explanation of the anisotropy served in the scattering of neutrons from various elements at ergies of a few hundred keV, the order of magnitude of the neutron larizability is estimated by making use of data on photoproduction pions. A polarizability α greater than $\sim 2 \times 10^{-42}$ cm^3 appears likely on this basis. There remains an unexplained factor of ~ 50 ich has to be accounted for either in the polarizability or by oviding another explanation of the neutron scattering anisotropy. e possibility of explaining the anisotropy on the basis of ordinary attering theory does not appear to be excluded. The exact propor- nality of the coefficient of $\cos\theta$ to the neutron momentum does ll for an r^{-4} type of potential, but it is not clear whether the energy pendence of the coefficient is sufficiently well determined by the ta and whether the compound nucleus features of the interaction are pable of explaining the observations. Nevertheless, a few less ual effects are estimated. These are the interaction of the neutron oment with the vacuum polarization charge and with the external ectric field of the nucleus as well as its interaction with the elec- ic charge density at the nuclear surface. The latter is hard to stinguish from other nuclear effects. The former two effects are all and do not resemble the observed effects.

539.12

60. RADON NEUTRON SOURCES. M.A.Bak, G.V.Gorshkov,
I.Matvienko, K.A.Petrzhak and Yu.F.Romanov.
l. Inst. Politeh. Iasi, Vol. 3(7), No. 1-2, 47-54 (1957). In Russian.

The following neutron sources were investigated by measuring e spatial distribution of the thermal neutron density in water: n + Be, Rn + B, Rn + C, Rn + CaF$_2$, Rn + Mg, Rn + A and Rn + Si. he neutron yields, the relaxation lengths L, the mean energies of e neutron spectra E, and the mean squares of the distance r^2 were easured. The experimental results are discussed.

539.12

61. INTENSITY OF A Po—Be NEUTRON SOURCE WITH n—γ OINCIDENCE METHOD. A.Fasana and V.Sangiust.
nergia nucleare, Vol. 5, No. 12, 834-8 (Dec., 1958).

A Hornyak ZnS—Lucite scintillator was used to detect neutrons om a Po—Be source. γ-rays were detected by a NaI crystal. eutrons and γ-rays were counted separately and in coincidence. he results were combined to give the absolute intensity of the urce. P.G.Murphy

539.12

62. THE PROPERTIES OF LIGHT AND HEAVY MESONS.
.Gentner.
aturwissenschaften, Vol. 46, No. 9, 283-9 (1959). In German.

Describes qualitatively the detection, production and decay of esons. Interactions with nucleons are briefly discussed.
S.J.St-Lorant

539.12 : 530.145

9963. ON A SYSTEMATIC CLASSIFICATION OF MESONS AND BARYONS. K.H.Yiglane.
Zh. eksper. teor. Fiz., Vol. 34, No. 5, 1337-8 (May, 1958). In Russian. English summary : PB 141052T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The author's scheme (Abstr. 3710 of 1959) for the classification of baryons on the basis of two quantum numbers, the third components of isotopic spin t_3 and of isotopic moment v_3, is extended to include K- and π-mesons. Experimental evidence indicates that both quantum numbers are conserved in strong and electromagnetic interactions, whereas in weak interactions they both change by $\pm\frac{1}{2}$. A.Ashmore

539.12 : 530.145

9964. DECAY OF THE CASCADE PARTICLES.
W.B.Teutsch and E.C.G.Sudarshan.
Phys. Rev., Vol. 114, No. 4, 1148-9 (May 15, 1959).

A phenomenological investigation of the decay of the cascade particles is presented. Several possible correlation measurements, which exploit the large asymmetry in Λ^0 decay as an analyser of Ξ, are suggested. One of these experiments does not require polarized Ξ's. The relation to the theory of universal weak interactions is briefly discussed.

539.12

9965. PRELIMINARY REMARKS ON A CONSEQUENCE OF THE ISOBAR MODEL OF MULTIPLE MESON PRODUCTION.
H.W.Meier.
Nuovo Cimento, Vol. 11, No. 2, 307-10 (Jan. 16, 1959).

A study is made of the relativistic kinematics of the two-centres-model of multiple meson production. An expression is obtained for the angle between the directions of the emitting centres in terms of the Lorentz factors of the laboratory system with respect to the centre of mass system (γ_C) and of the two centres in the laboratory system (γ_1 and γ_2). The isobar model is used to express γ_C in terms of γ_1 and γ_2 and other properties of the shower. Approximate methods are used to determine γ_1 and γ_2 from the shower data. The results are compared with information on two particular jets and good agreement is obtained. E.J.Squires

539.12

9966. HYDRODYNAMICAL MODEL AND INELASTICITY IN MULTIPLE PRODUCTION OF PARTICLES. C.Iso and M.Namiki.
Nuovo Cimento, Vol. 11, No. 3, 440-2 (Feb. 1, 1959).

A two-fluid hydrodynamical model, representing mesons and nucleons separately, is used to calculate the "inelasticity" (i.e. the fraction of the energy appearing in produced mesons) in high-energy nuclear interactions. R.J.N.Phillips

539.12 : 530.145

PHYSICAL NUCLEON IN STATIC SOURCE MESON THEORY.
See Abstr. 9229

539.12

9967. A MEASUREMENT OF THE EFFECT OF THE COULOMB FIELD OF A NUCLEUS ON THE DECAY RATE OF NEGATIVE MUONS. A.Astbury, M.Hussain, M.A.R.Kemp, N.H.Lipman, H.Muirhead, R.G.P.Voss and A.Kirk.
Proc. Phys. Soc., Vol. 73, Pt 2, 314-16 (Feb., 1959).

Negative muons brought to rest in matter decay or are captured by nuclei. In estimating the capture rate it has previously been assumed that the decay rate of the positive muon is equal to that of the negative muon, but differences are expected due to the distortion of the phase space, time dilation and distortion of the wave-function of the electron by the Coulomb field. The decrease in the decay rate due to the two former effects is calculated. The authors had previously obtained the total rate of loss due to decay and capture $\lambda_L(Z)$. The values of capture $\lambda_C(Z)$ and decay $\lambda_D(Z)$ may be obtained separately by measuring the fraction of stopped muons (f) which emit an electron. It is more practicable to obtain relative values of f for two materials, R(Z). If one of these materials has a small atomic number, the effect of the Coulomb field may be determined. For the materials copper—polythene and copper—aluminium the ratios R(Z) show that the change in decay rate of a negative muon due to atomic binding is small, giving a small correction to the previously determined $\lambda_C(Z)$.
A.E.I. Research Laboratory

539.12

9968. ON THE ANNIHILATION OF $\mu^+\mu^-$ AND THE DECAY OF NEUTRAL MESONS. Ya.B.Zel'dovich.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 646-7 (Feb., 1959).
In Russian.

The appearance of electron-pairs in these processes is discussed. P.K.Kabir

539.12

9969. REDETERMINATION OF THE μ^+ MEAN LIFE.
R.A.Swanson, R.A.Lundy, V.L.Telegdi and D.D.Yovanovitch.
Phys. Rev. Letters, Vol. 2, No. 10, 430-1 (May 15, 1959).

The mean life of the μ^+-meson is determined by a method whereby systematic errors due to inaccuracy and non-linearity of the time measurement, the time-dependent effects of background and any possible precession of μ^+-mesons at rest are greatly reduced. The result, $\tau(\mu^+) = 2.261 \pm 0.007$ μsec is in agreement with the predictions of the conserved V-current theory of weak interactions. S.J.St-Lorant

539.12

9970. EXAMPLES OF DIRECT EMISSION OF β-RAYS AFTER CAPTURE OF A μ-MESON BY AN ARGON NUCLEUS.
R.A.Donald and G.R.Evans.
Nuovo Cimento Suppl., Vol. 9, No. 2, 385-9 (1958).

Three events are described in which cosmic-ray μ-mesons stopped in the argon filling of an expansion cloud-chamber, and subsequently emitted electrons of 2 or 3 MeV energy. They are shown to be inconsistent with μ-meson decays, or with Auger electrons, and it is suggested that they may arise from the β-decay of a hitherto undetected isomeric state of Cl^{40}. S.J.Goldsack

539.12 : 539.18

DEPOLARIZATION OF μ^--MESONS IN μ-MESIC ATOM FORMATION. See Abstr. 8682

539.12

9971. THE ANOMALOUS NUCLEAR SCATTERING OF HIGH ENERGY MUONS. K.M.Gatha and V.B.Kelkar.
Curr. Sci., Vol. 28, No. 3, 107-8 (March, 1959).

Assuming that the multiple nuclear scattering of cosmic-ray muons is anomalously consistent with the electrostatic scattering by a point nucleus, the authors ascribe the anomalous scattering to a muon—nucleon interaction which is represented by a complex potential for an extended nucleus. Treating this potential by Born approximation, comparison is made with experiment. P.K.Kabir

539.12

9972. ABSORPTION OF POLARIZED μ^--MESONS BY NUCLEI.
E.I.Dolinskii and L.O.Blokhintsev.
Zh. eksper. teor. Fiz., Vol. 34, No. 3, 759-61 (1958). In Russian.
English translation in: Soviet Physics—JETP (New York), Vol. 34(7), No. 3, 521-3 (Sept., 1958).

The coefficient α in the angular distribution $(1 + \alpha \cos \Theta)$ of neutrons produced by the capture of polarized μ^--mesons by free protons is calculated in the case of absorption of μ^--mesons by bound protons, assuming scalar, vector, tensor and pseudo-vector forms of the four-fermion interaction of μ-mesons with nucleons. S.J.St-Lorant

539.12

9973. THEORETICAL CONSIDERATIONS ON THE DISINTEGRATION $\pi \rightarrow \mu$. Ş.Ţiţeica.
Rev. de Physique (Bucarest), Vol. 3, No. 3-4, 171-87 (1958). In French.

Since there has been some experimental indication of an anisotropic angular distribution of muons from pions decaying at rest, theoretical expressions are derived for this distribution in terms of the pion spin and the polarization of the decaying pions. The pion is assumed to decay into a muon and a zero mass neutrino, but no assumptions are made about the conservation of parity, i.e. the two component theory is not involved. A.Ashmore

539.12

9974. ON THE ANGULAR DISTRIBUTION OF THE POSITIVE MUONS GENERATED BY A π—μ DECAY.
N.P.Bogachev, A.K.Mikhul, M.G.Petrashku and V.M.Sidorov.
Zh. eksper. teor. Fiz., Vol. 34, No. 2, 531-2 (1958). In Russian.
English summary : PB 141052T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The authors of several recent publications (e.g. Abstr. 280 of 1958) claim to have detected asymmetries in the decay of the π-meson with respect to the direction of its emission. The present authors have conducted an experiment in which 10 000 π—μ decay events were examined in nuclear emulsions. The coefficient of asymmetry of the angular distribution was $+0.009 \pm 0.018$, zero within the observational errors. Reasons are discussed for apparent effects observed in other experiments. S.J.Goldsack

539.12

9975. MASS-550 PARTICLE. M.Conversi, G.M.de Munari, A.Egidi, F.Fiorini, S.Ratti, C.Rubbia, C.Succi and G.Torelli.
Phys. Rev., Vol. 114, No. 4, 1150-1 (May 15, 1959).

At an altitude of 2550 m a search has been carried out for the 550 mass particle which, at the Moscow International Conference in May, 1956, was reported to exist with an abundance of 0.5% relative to muons of the same range. Preliminary evidence against this datum is now reinforced by the results of a new series of measurements in which particles heavier than pions but lighter than protons are selected by means of two Cherenkov counters. The mass of each selected particle is derived from measurements of energy loss in a proportional scintillator, and range in a large multiplate cloud chamber. The latter alone yields substantial information on the nature of the stopping particles. No example of a mass 550 particle has been found out of the 25 expected on the basis of the reported abundance.

539.12

9976. ON THE CHIRALITY INVARIANCE OF THE PION—NUCLEON INTERACTIONS. Kuo-Hsien Tzou.
C.R. Acad. Sci. (Paris), Vol. 248, No. 9, 1300-3 (March 2, 1959).
In French.

539.12

9977. INTERACTION OF 4.5 GeV PIONS WITH EMULSION NUCLEI. A.Husain and M.H.Siddique.
Nuovo Cimento, Vol. 11, No. 3, 438-9 (Feb. 1, 1959).

Stars produced in nuclear emulsions by 4.5 GeV π^- mesons have been examined for shower, grey and black tracks. The results are compared with those at other energies, and it is shown that the average number of shower particles increases with energy. S.J.Goldsack

539.12

9978. IN CONNECTION WITH P.V.VAVILOV'S LETTER "INTERACTION CROSS-SECTION OF π-MESONS WITH NUCLEONS AT HIGH ENERGIES". N.P.Klepikov.
Zh. eksper. teor. Fiz., Vol. 34, No. 2, 533-4 (Feb., 1958).
In Russian. English summary: PB 141052T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

A comment on Vavilov's letter (Abstr. 9925 of 1957) in which inverse dispersion relations are used for the calculation of the pion—nucleon interaction cross-section in the extreme high-energy limi (σ_∞ = 30 mb). In this letter it was checked that the result obtained by means of inverse dispersion relations is identical with that obtained by means of direct dispersion relations, but no comparison was made with experimental data. The author now shows that the cross-section $\sigma(\omega)$ for any arbitrary high frequency ω can be computed by eliminating the real part of the forward scattering amplitu for the direct and inverse dispersion relation. Further, it is shown that, for a simple example, this procedure leads to agreement of th calculated value σ_∞ with the extrapolated experimental value. G.Martel

539.1

9979. INVESTIGATION OF THE $\pi^+ + d = 2p$ REACTION FOR 174-307 MeV π^+ MESONS. B.S.Neganov and L.B.Parfenov.
Zh. eksper. teor. Fiz., Vol. 34, No. 3, 767-8 (March, 1958).
In Russian. English translation in: Soviet Physics—JETP (New York), Vol. 34(7), No. 3, 528-9 (Sept., 1958).

The differential and total cross-sections for the reaction were determined at incident pion energies of 174, 200, 227, 262 and 307 MeV, and the resonance character of the reaction confirmed. S.J.St-Lora

539.1

9980. ON THE OBSERVATION OF π-MESONS EMITTED IN THE INTERACTION IN EMULSION OF K^--MESONS.
M.C.Amerighi, F.Baldassare, M.Beniston, A.Bonetti, D.H.Davis, M.Di Corato, C.Dilworth, E.Ferreira, E.Frota-Pessoa, W.B.Lasic N.Raina, M.Rene, J.Sacton and A.E.Sichirollo.
Nuovo Cimento, Vol. 12, No. 1, 91-5 (April 1, 1959).

A careful study is reported of the emission of π-mesons from

18 stars formed by the capture of K$^-$-mesons. 39.2 ± 2% of the srs were associated with a π-meson, a figure rather higher than vious estimates.

S.J.Goldsack

539.12

981. THE FORMATION OF POSITIVE PIONS BY NEGATIVE IONS.

Yu.P.Dobretsov and B.A.Nikol'skii.

Z eksper. teor. Fiz., Vol. 34, No. 2, 510-11 (1958). In Russian. Eglish translation in: PB 141052T-1, obtainable from Office of Tchnical Services, U.S. Dept. of Commerce, Washington, D.C., U.A.

A stack of nuclear emulsions, exposed to a 340 ± 30 MeV π beam, was scanned for examples of the characteristic decay of the π meson. The π$^+$ meson tracks were then traced back to their pnt of production. Fifty-six were produced in interaction of negat e pions from the beam. In 21 of these another meson was also eitted, so that these are cases of production of π$^+$ mesons. The rnainder are probably cases in which the π$^-$ had been absorbed in t nucleus after π$^+$ production. The cross-section for production o π$^+$ in the region 0-60 MeV is estimated to be (2.1 ± 0.8) × 1^{-27} cm^2.

S.J.Goldsack

539.12

982. MULTIPLE SCATTERING CORRECTIONS IN π—DEUTERON SATTERING.

V.De Alfaro and R.Stroffolini.

Novo Cimento, Vol. 11, No. 3, 447-52 (Feb. 1, 1959).

The calculation of multiple scattering is made tractable by the e of a separable π—nucleon interaction. Results are given for tal and differential cross-sections at 85 and 190 MeV. Contrary t the usual belief the multiple scattering correction, at least with ts form of interaction, is appreciably larger than the double sattering correction.

E.J.Squires

539.12

983. ON THE SYMMETRIES CONCERNING THE SCHEME OF EMENTARY PARTICLES.

N.Dallaporta.

Novo Cimento, Vol. 11, No. 1, 142-8 (Jan. 1, 1959).

It is shown that the proposal of Pais, that charged and neutral Kmesons have opposite parities, may be accommodated in a scheme pposed earlier by the author (Abstr. 1855 of 1958) by regarding t K-mesons as belong to two triplet groups, whose hypothetical trd members would have the same quantum numbers as the π^0.

P.K.Kabir

539.12

984. ANGULAR DISTRIBUTION IN THE REACTIONS K → 2π$^+$ + π$^-$ AND K$^+$ → 2π^0 + π$^+$.

V.N.Gribov.

Z. eksper. teor. Fiz., Vol. 34, No. 3, 749-51 (March, 1958). I Russian. English translation in: Soviet Physics—JETP (New Yrk), Vol. 34(7), No. 3, 514-15 (Sept., 1958).

The dependence of the disintegration probability on the angle θ bween the relative momentum of the identically charged π-mesons ad the momentum of the third meson is calculated. For sufficiently sall values of the relative kinetic energy of the three π-mesons t contribution of interactions between pairs of particles to the agular distribution becomes more important than direct emission tough the centrifugal barrier. The angular distribution obtained dpends on whether "time-parity" is conserved.

A.E.I. Research Laboratory

539.12

985. ON THE DETERMINATION OF THE VARIANTS OF K$_3$-DECAY.

I.Yu.Kobzarev.

Z. eksper. teor. Fiz., Vol. 34, No. 5, 1347-9 (May, 1958). In ssian. English summary: PB 141052T-2, obtainable from Office o Technical Services, U.S.Dept. of Commerce, Washington, D.C., U.S.A.

It is shown that a geometrical plot of the decay events, similar t the one proposed by Dalitz (Abstr. 8702 of 1953) for the τ-mode, my be used to determine the form of the interaction responsible f these decays if it is assumed to have the general form given by is and Treiman (Abstr. 4763 of 1957).

P.K.Kabir

539.12

986. LIFETIME OF THE K$_2^0$-MESON.

Yu.Kobzarev and L.B.Okun'.

Z. eksper. teor. Fiz., Vol. 34, No. 3, 763-4 (1958). In Russian. Egligh translation in: Soviet Physics—JETP (New York), Vol. 34(7), N. 3, 524-5 (Sept., 1958).

The authors invoke the ΔT = ½ rule to calculate the probabilities the different decays of the K$_2^0$-meson and to estimate its lifetime. nsidering only corrections in the statistical weights, they find K$_2^0$) = 3.8 × 10^{-8} sec.

S.J.St-Lorant

539.12

9987. A POSSIBLE EXPERIMENTAL TEST OF THE RELATIVE PARITY OF CHARGED AND NEUTRAL K'S.

G.Morpurgo.

Nuovo Cimento, Vol. 11, No. 5, 738-9 (March, 1959).

It is suggested that a practical method would be to study the angular distribution or energy dependence near threshold of the production of K's by the interaction of π$^\pm$ mesons with nuclei.

E.J.Squires

539.12

9988. SYMMETRIES IN K$^-$-INTERACTION.

Y.Eisenberg and W.Koch.

Nuovo Cimento, Vol. 11, No. 3, 453-7 (Feb. 1, 1959).

Formulae are deduced for the reaction rates of the two-nucleon K$^-$ capture assuming charge independance and global symmetry. The relations between the yields of the various hyperon—nucleon final states are compared with those assuming only charge independence. It is suggested that there is some indication that single nucleon K$^-$ capture fulfils charge independence relations but not global symmetry.

A.Ashmore

539.12

9989. THE ATTRACTIVE K$^-$-MESON PROTON INTERACTION.

E.M.Ferreira.

Nuovo Cimento, Vol. 11, No. 6, 880-1 (March 16, 1959).

The experimental indication is that the K$^-$—proton interaction is attractive whereas that obtained from lowest order perturbation theory, i.e. the process K$^-$ + p → Y → K$^-$ + p, where Y is either a Λ or Σ hyperon, is repulsive. A calculation is made of the higher order diagram obtained by including the exchange of a π-meson between the incident and final protons. This gives a contribution which is attractive for all possible parities of the Λ and Σ and is almost certainly larger than the lowest order term.

E.J.Squires

539.12

9990. K-MESON NUCLEON INTERACTION.

R.Karplus, L.Kerth and T.Kycia.

Phys. Rev. Letters, Vol. 2, No. 12, 510-13 (June 15, 1959).

The K-nucleon—hyperon coupling terms are examined using the dispersion relation formalism. Two parameters are defined: $p_\Lambda(p_\Sigma)$ describing the K$^-$Λ(K$^-$Σ)-nucleon relative parity, and $X_\Lambda(X_\Sigma)$ which is proportional to the K$^-$ΛN (K$^-$ΣN) coupling constant $g^2_\Lambda(g^2_\Sigma)$. The calculation of an "average" coupling $\langle pX\rangle_{Av}$ at an "average" pole $\bar{\omega}\,[\bar{\omega} = \frac{1}{2}(\omega_\Lambda + \omega_\Sigma)$ where ω is the K-meson laboratory energy and $X_\Lambda(X_\Sigma)$ is the magnitude of the residue evaluated at $\omega = \omega_\Lambda(\omega_\Sigma)]$ leads to the conclusion that the K$^+$-proton interaction calculated by this method is insufficiently sensitive to the coupling parameters to permit their evaluation from present data. A consideration of the real part of the K$^-$-proton forward scattering amplitude suggests that the K$^-$-proton force is attractive.

S.J.St-Lorant

539.12

9991. K$^+$—DEUTERIUM SCATTERING. I.

M.Gourdin and A.Martin.

Nuovo Cimento, Vol. 11, No. 5, 670-8 (March 1, 1959).

The elastic, inelastic and charge exchange scattering of K$^+$-mesons by deuterium is calculated using the impulse approximation and neglecting the interaction between the nucleons in the final state. S-wave scattering only is considered. It is found that the ratio of the differential and total cross-sections for exchange scattering to those for non-exchange scattering are very sensitive to the T = 0 scattering amplitude.

C.J.Batty

539.12

9992. POSSIBLE POLARIZATION MEASUREMENTS IN K$^+$—H SCATTERING.

B.J.Malenka.

Nuovo Cimento, Vol. 11, No. 5, 725-6 (March 1, 1959).

The possibility of obtaining additional information about the K$^+$ meson—proton interaction, by measuring the polarization of the recoil proton in K$^+$—H scattering, is discussed.

C.J.Batty

539.12

9993. ON THE SCATTERING OF K-MESONS BY NUCLEONS.

C.Ceolin, V.De Santis and L.Taffara.

Nuovo Cimento, Vol. 12, No. 6, 502-12 (June 16, 1959).

The problem is studied in terms of direct pseudoscalar coupling K-Y-N. The purpose is to determine values of the pseudoscalar coupling constants g^2_Λ and g^2_Σ capable of fitting the experimental behaviour of K—proton elastic and K—neutron elastic and charge exchange cross-section. It has been found that, in the limits of the approximation used, no value can be determined for the ratio $Q = g^2_\Lambda/g^2_\Sigma$ which fits the experimental cross-section for all the energies investigated. Therefore it may be deduced that, assuming the quantum numbers attributed by the Gell-Mann–Nishijima scheme as correct and the theoretical procedure used as sufficiently reliable, the K–nucleon scattering phenomena cannot be interpreted in terms of K–Y–N direct coupling only.

539.12 : 530.145

9994. ASSOCIATED PRODUCTION BY NON-LOCAL INTERACTION. S.N.Biswas.

Nuovo Cimento, Vol. 11, No. 4, 606-8 (Feb. 16, 1959).

Non-local $NK\Lambda$ and $\pi NK\Lambda$ interactions are introduced, via a compound hypothesis for K-mesons and Λ-hyperons.

R.J.N.Phillips

539.12

9995. PHOTOPRODUCTION OF K MESONS AND K-HYPERON PARITIES. R.H.Capps.

Phys. Rev., Vol. 114, No. 3, 920-4 (May 1, 1959).

An investigation is made of the possibility of determining the intrinsic parities relative to the nucleon of K–Λ and K–Σ pairs by measuring the cross-sections for photoproduction of these pairs from nucleons near threshold. The low-energy S and P wave contributions are calculated in a perturbation theory similar to that of Kawaguchi and Moravcsik (see Abstr. 8890 of 1957). The question concerning the combination of nucleon and hyperon magnetic moments that is effective in the process is clarified. The calculated cross-sections are quite different from those given in the long photon wavelength approximation by Feld and Costa (see Abstr. 8999 of 1958). For most reasonable choices of the hyperon anomalous magnetic moments, certain calculated ratios of the close-to-threshold cross-sections corresponding to different K–Λ and K–Σ charge states are quite sensitive to the K-hyperon parity. A model, in which the anomalous moments are the result of globally symmetric pion interactions, is used to illustrate the conclusions.

539.12

9996. Σ^--Σ^+ MASS EXCESS. B.H.Bransden and R.G.Moorhouse.

Phys. Rev. Letters, Vol. 2, No. 10, 431-2 (May 15, 1959).

It is suggested that the major contribution to the Σ^-–Σ^+ mass splitting is obtained by considering the difference in self-energies of processes involving the $\bar{K}^0$ –$\bar{K}$ or the K^0–K^+ mass excess. A perturbation calculation shows that the pseudoscalar coupling of K-mesons to nucleons and the scalar coupling of K-mesons to the cascade particle yields the most favourable configuration for the Σ^-–Σ^+ splitting.

S.J.St-Lorant

539.12

9997. A REMARK CONCERNING THE BACKWARD–FORWARD ASYMMETRY IN Λ^0-DECAY. R.A.Salmeron and A.Zichichi.

Nuovo Cimento, Vol. 11, No. 3, 461-5 (Feb. 1, 1959).

The evidence is considered for the longitudinal polarization of Λ^0 hyperons, produced by π^--mesons in complex nuclei. A high momentum cut-off is applied to the cloud chamber results to avoid bias. Combined with machine data they then give for the backward–forward ratio of the decay protons 1.77 ± 0.25. There is contrary evidence from machine data analysed in Pisa giving equal numbers (33) backwards and forwards, although this was for a lower pion momentum. There is some discussion of the process which might produce the polarization from complex nuclei but not from hydrogen.

A.Ashmore

539.12

9998. THE $\Sigma \rightarrow p + \gamma$ DECAY INDUCED BY HEAVY VECTOR MESONS. P. Prakash and A.H.Zimerman.

Nuovo Cimento, Vol. 11, No. 6, 869-71 (March 16, 1959).

The suggestion of Feynman and Gell-Mann, that the universal (V-A) Fermi interaction arises from the exchange of heavy charged vector mesons, is used to calculate the branching ratios

$$\frac{P(\Sigma \rightarrow p + \gamma)\ \text{theo.}}{P(\Sigma \rightarrow p + \pi^0)\ \text{exp.}}\ \text{and}\ \frac{P(\Sigma \rightarrow p + \gamma)\ \text{theo.}}{P(\Sigma \rightarrow n + \mu^+ + \nu)\ \text{theo.}}\cdot$$

Values of 1.4×10^{-4} and 4.3×10^{-3} are obtained for these quantities. From the known value of the Michel parameter for muon decay it is concluded that the vector meson mass must be at least ten proton masses.

E.J.Squires

539.12

9999. UP–DOWN ASYMMETRIES OF Σ AND Λ DECAYS. B.d'Espagnat and J.Prentki.

Phys. Rev., Vol. 114, No. 5, 1366-7 (June 1, 1959).

Starting from a phenomenological analysis of the Σ decays an extension is made to Λ (and Ξ) decays using global symmetry (and M space). The relative values and signs of the asymmetry parameters are predicted.

539.

10000. DETERMINATION OF THE MASS OF THE Λ^0 HYPERON

J.Bogdanowicz, M.Danysz, A.Filipkowski, E.Marquit, E.Skrzypcza A.Wróblewski and J.Zakrzewski.

Nuovo Cimento, Vol. 11, No. 5, 727-9 (March 1, 1959).

Sixty one π^- mesons which came to rest in a stack of nuclear emulsions exposed to a beam of K^--mesons, were traced back to their origins in two-prong stars. In all but three of these the othe branch of the star ended in the stack, and so its range was determined. Fifty three events whose "Q" value lay within a well-defin peak gave a value for the mean $Q = 37.58 \pm 0.18$ MeV, correspondi to a mass 1115.42 ± 0.19 MeV for the Λ^0 hyperon.

S.J.Goldsa

539.

10001. A TENTATIVE EVALUATION OF THE N Ξ MASS DIFFERENCE. N.Dallaporta and G.Patergnani.

Nuovo Cimento, Vol. 12, No. 6, 523-30 (June 16, 1959).

An attempt is made to evaluate the N–Ξ mass difference by using a Lee model consisting of a bare baryon B with no electric charge nor hypercharge which may be clothed either with K-meso giving thus the nucleon or with K-mesons giving thus the Ξ. The mass difference between these two states is then attributed to a hypercharge-dependent perturbation consisting of the simultaneous emission and absorption of two K-mesons. The order of magnitud of this perturbation is discussed in order to obtain the experiment mass difference. The values thus obtained for it are such as to m this two-K interaction of small importance in K–nucleon scatterin processes.

539

10002. Ξ^-–Ξ^0 MASS DIFFERENCE J.J.Sakurai.

Phys. Rev., Vol. 114, No. 4, 1152 (May 15, 1959).

The electromagnetic self-energies of Ξ^- and Ξ^0 are discussed with reference to symmetry models of strong interactions.

539.

10003. HYPERFRAGMENTS FROM Ξ PARTICLE AND THE DETERMINATION OF THE Ξ PARITY. J.Szimański.

Nuovo Cimento, Vol. 11, No. 5, 730-2 (March 1, 1959).

The possibility of observing bound states of the Ξ particle wi nucleons is discussed. Observation of such hyperfragments and their decay schemes would then give information on the parity of the Ξ.

C.J.Bat

539.

10004. CONCERNING THE HYPERON–NUCLEON INTERACTI

L.I.Lapidus.

Zh. eksper. teor. Fiz., Vol. 34, No. 3, 777-9 (1958). In Russian. English translation in: Soviet Physics–JETP (New York), Vol. 34(No. 3, 535-6 (Sept., 1958).

Some remarks on the study of hypernuclei and hyperon–nucleon scattering.

R.J.N.Philli

539.

10005. ON THE HYPERON–NUCLEON SCATTERING AND REACTION CROSS SECTIONS. F.Ferrari and L.Fonda.

Phys. Rev., Vol. 114, No. 3, 874-7 (May 1, 1959).

The hyperon–nucleon cross-sections are analysed on the bas of symmetries among the pion–baryon interactions. It is shown t the assumption of the equality for the $(\Lambda\Sigma\pi)$ and $(\Sigma\Sigma\pi)$ coupling co stants leads to some inequalities between the different hyperon–nucleon scattering and reaction cross-sections which can be verif experimentally. On the hypothesis of global symmetry for the pio baryon interactions, the Σ^+-proton scattering is discussed by cho ing for the nucleon–nucleon potential that of Gammel–Thaler.

539

10006. ON THE THEORY OF "STRANGE" PARTICLES.

L.A.Manakin.

Zh. eskper. teor. Fiz., Vol. 34, No. 5, 1327-9 (1958). In Russian. English summary: PB 141052T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Discusses various ways of expressing the Gell-Mann–Nishij classification scheme.

R.J.N.Phil

539.12

07. A POSSIBLE PARITY ASSIGNMENT FOR STRANGE
RTICLES AND A NEW KIND OF HEAVY MESON. H.Katsumori.
ovo Cimento, Vol. 11, No. 4, 612-16 (Feb. 16, 1959).

It is conjectured that the four kinds of baryon, N, Λ, Σ and Ξ ,
e the four possible kinds of spinor transformation under space
lection. A new heavy meson is then postulated to help explain
ss differences. R.J.N.Phillips

539.12

08. DISPERSION RELATIONS FOR ASSOCIATED PRODUCTION.
.Jin.
ovo Cimento, Vol. 12, No. 5, 455-68 (June 1, 1959).

Formal derivation of relativistic dispersion relations for the
ociated production of strange particles by pion—nucleon collision
presented, however, without trying to give rigorous proof of deri-
ion concerning the analytic continuation of the causal amplitudes
the unphysical region. The matrix structure of causal ampli-
es in spin and isospin space is studied. Dispersion relations are
ained in covariant form as well as in Breit system separately for
n-flip or non-spin-flip and isospin-flip or non-isospin-flip
cesses of the associated production.

NUCLEUS

539.14

09. COLLECTIVE AND INTERPARTICLE INTERACTIONS IN
EN—EVEN NUCLEI. B.J.Raz.
ys. Rev., Vol. 114, No. 4, 1116-23 (May 15, 1959).

A calculation using two equivalent $f_{7/2}$ particles and adding sur-
e effects to the two-body interaction is reported. The effects of
reasing the strength of (a) the surface interaction and (b) the two-
ticle interaction are computed. The qualitative regularities ob-
ved in even—even nuclei in the so-called vibrational region are
ained and the agreement is somewhat better than that with the
e vibrational model. In contrast to earlier calculations, these
ults can give a spin of 2^+ for the second excited state, as often
erved. The calculated ratio of B(E2; 2' → 2) to B(E2; 2 → 0) is
s than 1.0. The appropriate values of the deformation parameters
re less than 1.0.

539.14

10. SOME NEW NUCLEON MAGIC NUMBERS. I.A.Vaisman.
. eksper. teor. Fiz., Vol. 34, No. 5, 1325-7 (May, 1958).
Russian. English summary: PB 141052T-2, obtainable from
ice of Technical Services, U.S. Dept. of Commerce, Washington,
., U.S.A.

It is suggested that N = 30 may be a magic number on the basis
neutron cross-sections of the Fe and Ni isotopes with 30 neutrons.
s also suggested that configurations of 42 or 60 protons, or
itrons, have certain magic properties. L.L.Green

539.14

11. DEUTERON WAVE FUNCTIONS AND PHENOMENO-
GICAL TWO-NUCLEON POTENTIALS. K.V.Laurikainen.
1. Acad. sci. Fennicae A VI, No. 27, 20 pp. (1959).

An investigation using a variational method. Central, non-
tral and hard core potentials, and the introduction of a spin-
it force, are considered. C.J.Batty

539.14

12. ON THE POSSIBILITY OF THE APPEARANCE OF A
PERFLUID STATE OF NUCLEAR MATTER IN A CASE WHERE
p AND n—n INTERACTIONS ARE TAKEN INTO ACCOUNT.
.Solov'ev.
l. Akad. Nauk SSSR, Vol. 123, No. 3, 437-9 (1958). In Russian.

In the model considered, the n—p interactions are neglected,
the p—p and n—n interactions are treated as weak and equal.
olyubov's theory of superconductivity is applied and leads to a
terion of superfluidity. This criterion is roughly that the poten-
should be attractive at the Fermi surface, and is in fact satisfied
the p—p interaction. O.Penrose

539.14

13. ON THE EFFECT OF LOCALIZED STATE SOLUTIONS OF
E BETHE—GOLDSTONE EQUATION. G.Lüders.
Naturforsch., Vol. 14a, No. 1, 1-5 (Jan., 1959). In German.

A discussion is given of the effect of possible localized solutions of the Bethe—Goldstone equation on the usual Brueckner theory analysis. It is shown that, corresponding to each solution, there is a singularity in some t matrix. In some cases these singularities will occur in the lowest order expression for the energy, but in other cases they will only arise when higher order clusters are considered. E.J.Squires

539.14

10014. THE Λ—NUCLEON POTENTIAL ACCORDING TO MESON THEORY AND THE ENERGY OF THE Λ-PARTICLE IN LIGHT HYPERNUCLEI. V.A.Filimonov.
Zh. eksper. teor. Fiz., Vol. 34, No. 5, 1355-6 (May, 1958).
In Russian. English summary: PB 141052T-2, obtainable from Office of Technical Services, U.S.Dept. of Commerce, Washington, D.C., U.S.A.

By the use of meson theory with a momentum cut-off, the Λ-nucleon potential is calculated. One-K, two-K and two-π processes are included in the potential, which is then used to calculate the binding energies of ${}_\Lambda H^3$, ${}_\Lambda H^4$ and ${}_\Lambda H^5$. The one-K part of the potential is positive and only one-tenth of the whole potential energy. Its strength depends on the spin of the hypernucleus, increasing with increasing spin. The two-K and two-π contributions do not depend greatly on the spin. Quantitative agreement with experiment is poor, but the known departure of the Λ—nucleon force from the pure Wigner type is obtained from the theory. E.J.Squires

539.14

10015. NUCLEAR SHELL STRUCTURE AND EXCITATION FUNCTIONS. M.E.Nahmias.
J. Phys. Radium, Vol. 19, No. 12, 961-2 (Dec., 1958). In French.

In order to further clarify Ghoshal's experiment (Abstr. 2991 of 1951) on the compound states of Zn^{64}, a table of similar possible experiments is proposed. J.Lascoux

539.14

10016. NUCLEAR MATRIX ELEMENTS FOR SOME 1ST-FORBIDDEN UNIQUE β TRANSITIONS. B.Oquidam and B.Jancovici.
Nuovo Cimento, Vol. 11, No. 4, 578-88 (Feb. 16, 1959).

The matrix elements are calculated, first with a model where the angular momenta of the proton group and of the neutron group are separately good quantum numbers; secondly, with more detailed wave-functions, which are linear combinations of the ones used in the first calculation. Relative values of the matrix elements are in good agreement with experimental data, but the absolute values are smaller by a factor 4. J.Lascoux

539.14 : 539.17

FOCUSING OF PARTICLES IN THE OPTICAL MODEL. See Abstr. 8568

539.14

10017. NUCLEAR SPINS OF I^{128} AND I^{130}.
J.E.Sherwood and S.J.Ovenshine.
Phys. Rev., Vol. 114, No. 3, 858-61 (May 1, 1959).

The spins were measured by means of an atomic beam magnetic resonance apparatus. A value of 1 was obtained for I^{128}, as predicted by Benczer et al. However, a value of 5 was obtained for I^{130}, in disagreement with the expectations of Caird and Mitchell. The nature of the discrepancy is indicated. The apparatus and technique are described, with special attention to the source and detector arrangements.

539.14

10018. SPIN OF ^{103}Ru BY DEUTERON STRIPPING.
P.Mason, F.C.Flack and G.Parry.
Proc. Phys. Soc., Vol. 73, Pt 1, 138-41 (Jan., 1959).

The low-lying states of Ru^{103} have been studied by magnetic analysis of the protons from the Ru^{102}(d,p) reaction. The proton groups due to Ru^{103} have been distinguished from those due to Ru^{102} by comparing the yields from separated and natural targets. The angular distributions of the proton groups have been measured and reasons are given for assigning $\frac{5}{2}^+$ to the ground state of Ru^{103} and $\frac{7}{2}^+$ to the 538 keV state. L.L.Green

539.14

10019. DYNAMIC POLARIZATION OF Si^{29} NUCLEI IN SILICON AT 4.2°K. A.Abragam, J.Combrisson and I.Solomon.
C.R. Acad. Sci. (Paris), Vol. 247, No. 25, 2337-40 (Dec. 22, 1958).
In French.

The polarization produced after irradiation at frequencies near that of the conduction electron resonance is identified, from the sign reversal of the polarization on passing through the exact electron resonance frequency, as due to a new effect (Abstr. 7316 of 1958) rather than to an Overhauser effect. E.F.W.Seymour

539.14 : 539.17

SPIN AND PARITY OF THE INTERMEDIATE LEVELS IN P^{31}. See Abstr. 8577

539.14

10020. MAGNETIC MOMENT OF THE FIRST EXCITED STATE OF ${}_{62}Sm^{152}$.

K.Sugimoto.

J. Phys. Soc. Japan, Vol. 13, No. 3, 240-3 (March, 1958).

The first excited state (122 keV) of the even—even nucleus Sm^{152} was excited by the Coulomb excitation with 2 MeV protons. The angular distribution of the de-excitation radiation was investigated. The attenuation factor of the angular distribution $G_2 \cong 0.6$ was obtained using a samarium oxide target. The rotational change of the pattern in the angular distribution was examined under the condition of applying an external magnetic field vertical to the incident protons. The apparent g-factor for this state obtained was $g(Sm^{152}, 2^+) = +(0.36 \pm 0.16)$ n.m. A brief discussion about the effect of nuclear surroundings affecting the present determination was given.

539.14

10021. NUCLEAR MAGNETIC MOMENTS OF Sr^{87} AND Mg^{25}.

A.G.Kucheryaev, Yu.K.Szhenov, Sh.M.Gogichaishvili, I.N.Leont'eva and L.V.Vasil'ev.

Zh. eksper. teor. Fiz., Vol. 34, No. 3, 774-5 (March, 1958). In Russian. English translation in : Soviet Physics—JETP (New York), Vol. 34(7), No. 3, 533 (Sept., 1958).

An atomic beam resonance method is used. The results obtained were: $g(Sr^{87}) = 0.2423 \pm 0.0003$, $\mu(Sr^{87}) = 1.0939 \pm 0.0014$ nuclear magnetons. There is no mention of work on Mg^{25}.

D.J.Oliver

539.14

10022. ON THE THEORY OF NUCLEAR MAGNETIC MOMENTS.

D.F.Zaretskii.

Zh. eksper. teor. Fiz., Vol. 36, No. 3, 869-73 (1959). In Russian.

Due to a strong spin—orbit coupling an additional interaction between nucleons in the nucleus and the electromagnetic field arises. The effect of this additional factor on nuclear magnetic moments is considered for spherical, as well as nonspherical, nuclei. It is shown, in particular, that about half of the anomalous deviation of the magnetic moment of Bi^{209} from the Schmidt line may be due to this effect.

539.14

10023. THE MAGNETIC MOMENT OF THE 181 keV LEVEL OF TECHNETIUM 99.

E.Bodenstedt, E.Matthias and H.J.Körner.

Z. Phys., Vol. 153, No. 4, 423-39 (1959). In German.

The g-factor was determined by measuring the angular correlation of the 741-181 keV gamma—gamma cascade in an external magnetic field. The result, $g = +1.44 \pm 0.13$, yields a magnetic moment of 3.6 ± 0.3 nuclear magnetons for the spin assignment 5/2. A study of the disintegration confirmed the known decay scheme but an additional gamma-ray of 950 keV was found. Coincidence measurements proved that this γ-ray is a transition to the 181 keV level. A new determination of the half-life of the 181 keV level confirmed the known value, but the limits of error were reduced to: $T_{1/2} = 3.57 \pm 0.05 \times 10^{-9}$ sec. The angular correlation function of the 741-181 keV cascade was measured, together with that of the 741-41-140 keV triple cascade. The source was prepared as ammonium molybdate in liquid solution. Delayed coincidence measurements showed weak perturbations by internal fields. The results are discussed.

539.14 : 539.166

MAGNETIC MOMENT OF Cs^{133}. See Abstr. 8551

539.14

10024. QUADRUPOLE VIBRATIONS AND THE ELECTRIC QUADRUPOLE MOMENT OF SOME CLOSED SHELL PLUS (OR MINUS) A SINGLE NUCLEON NUCLEI.

P.N.Mukherjee and I.Dutt.

Indian J. Phys., Vol. 32, No. 3, 149-54 (March, 1958).

A critical survey is made of the present position of the quadrupole moment of closed shell nuclei plus (or minus) a single nucleon. It is found that collective model formalism of the quadrupole moment is essentially correct if one calculates the rigidity of the core from the data on the vibrational spectra of even—even nuclei. Using the available data on vibrational levels the strength of surface coupling has been calculated and it is found that in the region of closed shell, an intermediate coupling picture holds true. The values of the quadrupole moment are also improved in this scheme.

539.1

10025. UNNATURAL PARITY STATES IN O^{16}. I.

D.A.Bromley, H.E.Gove, J.A.Kuehner, A.E.Litherland and E.Almqvist.

Phys. Rev.,Vol. 114, No. 3, 758-74 (May 1, 1959).

A detailed study of the de-excitation of gamma emitting states in O^{16} at 8.87, 10.94, and 11.06 MeV has been carried out using the $N^{14}(He^3,p\gamma)O^{16}$ reaction. Branching ratios and angular distribution measurements on both proton groups and gamma radiations strongl suggest assignments 2^-, 0^-, and 3^-, respectively, although in the latter case the 2^- possibility is not excluded. The experimental results are compared with predictions of the alpha-particle and intermediate-coupling shell models. While considerable areas of agreement exist, serious discrepancies remain in both cases. The identification of the 0^-, 10.94 MeV state precludes Dennison's preferred "identification (a)" in the alpha-particle model and fixes the exchange mixture in the shell model calculations; the O^{16} mixtu closely resembles a Serber rather than the Rosenfeld mixture commonly in use in these shell model calculations. From the measured de-excitation branching ratio $\Gamma_\alpha/\Gamma_\gamma$ for the 10.94 MeV state and the systematics of gamma-radiation and alpha-particle transition widths, an upper limit of $\sim 2 \times 10^{-9}$ is obtained for the relativ intensity of an opposite-parity component in the wave-function of this state.

539.1

10026. UNNATURAL PARITY STATES IN O^{16}. II.

J.A.Kuehner, A.E.Litherland, E.Almqvist, D.A.Bromley and H.E.Gove.

Phys. Rev., Vol. 114, No. 3, 775-85 (May 1, 1959).

Measurements on both proton and gamma angular distributions and on proton—gamma angular correlations from the $N^{14}(He^3,p\gamma\gamma)O$ reaction suggest that for an incident energy of 2.1 MeV and target thicknesses corresponding to between 200 and 350 keV for these He^3 ions, the excited states of O^{16} are formed with equally populate magnetic substates. A number of gamma—gamma angular correlations have been studied from this reaction; these support the hypothesis of equal substate populations for the 8.87, 10.94, and 11.06 MeV states. On this hypothesis, the quadruple angular correlations studied reduce to effective double gamma—gamma correlations which are amenable to much simpler analysis. Using this hypothes gamma—gamma angular correlation data have been used in conjunc tion with the data on the relative gamma-ray de-excitation probabil ities of the excited states of O^{16} to fix the spins and parities of the levels at 8.87, 10.94, and 11.06 MeV as 2^-, 0^-, and 3^+, respectively In addition the multipole amplitude ratios have been obtained for a number of the transitions involved in the calculations; these are us to calculate M1 inhibition factors expected for $\Delta T = 0$ transitions self-conjugate nuclei and these in turn are compared with the theo etical estimates for this inhibition. Where intermediate-coupling shell model predictions are available for the multipole mixtures they are also compared with the experimental results; an anomalo low value of the depth of the central potential used in these calcula tions is required for agreement.

539.14 : 539.16

THE LEVEL STRUCTURE OF Dy^{160}. See Abstr. 8532

539.

10027. SPIN DEPENDENCE OF NUCLEAR LEVEL SPACINGS.

A.G.W.Cameron.

Canad. J. Phys., Vol. 37, No. 2, 244-5 (Feb., 1959).

An improved version of a formula for nuclear level spacing given in a previous paper (Abstr. 584 of 1959) is obtained by elim inating the customary approximation for spin dependence.

L.L.Gr

539.14 : 539.1

10028. AN INVESTIGATION OF THE EXCITED STATES OF Mn AND Fe^{55}, AND A DESCRIPTION OF A COINCIDENCE MEASURI APPARATUS.

H.Guhl.

Dissert. E.T.H. Zürich, No. 2797, 41 pp. (1958). In German.

The de-excitation by γ-emission of the excited states in Mn and Fe^{55} produced by the Mn^{56} (p,n) and Mn^{55} (p,p') reactions for incident proton energies between 1.5 and 4.0 MeV forms the basi of a study of the level-structure of these nuclei. Good agreemen with previous experiments is obtained. A major portion of the p is devoted to the description of the coincidence circuitry employ particular emphasis being laid on the switching of the linear gat and the properties of the pulse-height analyser. Attention is giv to problems of calibration and background-elimination of the NaI scintillators used.

S.J.St-Lo

539.14

029. ON THE LOW LYING LEVELS OF Mn^{55}. S.Yanagawa.

Phys. Soc. Japan, Vol. 13, No. 4, 323-4 (April, 1958).

In this calculation the treatment is from the standpoint of the nfigurational mixings. It is assumed that the potential between cleons is $V(r_{12})[1 + a(\sigma_1 \cdot \sigma_2)]$: $V(r) = V_0 e^{-r^2/r_0^2}$, and the wave- ctions are the harmonic oscillator type due to Talmi. λ is the tio of the potential range r_0 to $1/\sqrt{\nu}$ which determines the extension the wave-function. The values of a and λ are determined from experimental data of the energy splittings of the J = 0, 2 and 4 vels for Fe^{56}. And for these values of parameters, the competition the low-lying levels J = 7/2, 5/2 and 3/2 for Mn^{55} is discussed.

539.14

030. EXCITED STATES OF ^{40}Ca.

Hirao, E.Okada, I.Miura and T.Wakatsuki.

Phys. Soc. Japan, Vol. 13, No. 3, 233-7 (March, 1958).

By bombarding a natural calcium target with 5.7 MeV protons, mma-rays of energy 3.7 MeV and 3.9 MeV were observed with a I(Tl) three crystal pair spectrometer. The intensity of 3.7 MeV mma-ray is about 25% of 3.9 MeV gamma-ray. Angular distribu- n of these gamma-rays was measured with a single crystal intillation spectrometer; the result can be expressed as follows: $1.90 \cos^2\theta - 1.03 \cos^4\theta$. From comparison with theory it is hly probable that the 3.90 MeV state has spin 2.

539.14

031. LOWER EXCITED STATES OF Ca^{42}.

Morinaga, N.Mutsuro and M.Sugawara.

ys. Rev., Vol. 114, No. 4, 1146-7 (May 15, 1959).

Weak gamma-rays in the decay of K^{42} were investigated in der to give spin-parity assignments for low-lying excited states of ^{42}. The second excited state was found to be a 0^+ state from ectional correlation measurements and the third excited state has v spin value, probably 2^+. Except for these two states the level quence seems to be very much like that of Ti^{50} which has a similar nfiguration of two $f_{7/2}$ nucleons outside of a doubly magic core.

539.14

032. ENERGY LEVELS OF LIGHT NUCLEI. VI.

Ajzenberg-Selove and T.Lauritsen.

clear Phys., Vol. 11, No. 1, 1-340 (May (2), 1959).

For Pt V, see Abstr. 7273 (1955). Information summarizing the ergy levels of nuclei from He^5 to Ne^{24}. Each nucleus is repre- nted by a diagram and tables in which the known energy levels and reactions in which they are involved are indicated. Each reaction briefly discussed, with many references to a very extensive liography of articles published before December 1958.

C.J.Batty

539.14

033. LIFETIME OF THE FIRST EXCITED STATE OF K^{40}.

J.Lynch and R.E.Holland.

ys. Rev., Vol. 114, No. 3, 825-6 (May 1, 1959).

The first excited state of K^{40} at 29.4 keV has been produced by ing the reaction A^{40}(p,n)K^{40}. Its mean life, measured by a pulsed- am technique, is 5.6 ± 0.5 mμsec.

539.14

034. EXPERIMENTS CONCERNING THE LOW-ENERGY ATES OF THE O^{19} NUCLEUS. W.Zimmerman, Jr.

ys. Rev., Vol. 114, No. 3, 837-46 (May 1, 1959).

Angular distributions have been measured for three groups of otons from the O^{18}(d,p)O^{19} reaction, those leaving O^{19} in its states 0, 0.096, and 1.47 MeV. Deuteron energies of 1.74 and 2.50 MeV in laboratory system were used. The distributions of protons aving O^{19} in its ground state and in its 1.47 MeV state are charac- ristic of stripping and indicate the formation of the ground state an $l = 2$ neutron and of the 1.47 MeV state by an $l = 0$ neutron. wever, the distribution of protons leaving O^{19} in its 0.096 MeV ate does not lend itself to a stripping interpretation. It has been und that the γ decay of the 1.47 MeV state of O^{19}, following the rmation of this state in the O^{18}(d,p)O^{19} reaction, proceeds mostly to 0.096 MeV state. The mean life of the 0.096 MeV state has been asured by observing the decay in flight of recoiling excited O^{19} clei and is found to be $1.75(1 \pm 0.16) \times 10^{-9}$ sec. These observa- ns restrict the likely assignments of spin and parity for the 096 MeV state to $\frac{3}{2}^{\pm}$ or $\frac{5}{2}^{+}$.

539.14

10035. LIFETIME OF THE FIRST EXCITED STATE OF Li^7.

C.P.Swann, V.K.Rasmussen and F.R.Metzger.

Phys. Rev., Vol. 114, No. 3, 862-6 (May 1, 1959).

The Li^7(p,p')Li^{7*} reaction was used as the source of Doppler-broadened 478 keV gamma rays to determine the mean life of the first excited state of Li^7 by the nuclear resonance fluorescence technique. Both scattering and self-absorption experiments using both LiF and Li as the scattering and absorbing materials were performed. The resonance scattering gives a mean life of $(1.09 \pm 0.07) \times 10^{-13}$ sec after a 2% correction for slowing down of the Li^{7*} nuclei has been made. This correction follows from the measured stopping cross-sections for lithium ions. An additional correction, for the effect of collisions in which the Li^7 nuclei lose a large fraction of their energy is found difficult to estimate, although it is certainly not more than a few per cent. For this reason, the scattering measurement is regarded as giving a lower limit for the mean life. The self-absorption measurements give a mean life of $(1.15 \pm 0.14) \times 10^{-13}$ sec. Debye temperatures of 400°K and 700°K were used for Li and LiF, respectively. The error given, about twice the statistical error of the data, includes estimates of the effect of other experimental uncertainties.

539.14

10036. LIFETIME OF THE 0.119 MeV STATE OF THE N^{16} NUCLEUS. W.Zimmermann, Jr.

Phys. Rev., Vol. 114, No. 3, 867-9 (May 1, 1959).

The mean life was measured and found to be $7.83(1 \pm 0.04) \times 10^{-6}$ sec. This state was produced by means of the N^{15}(d,p)N^{16} reaction with deuterons having a laboratory energy of 1.76 MeV. The experiment involved periodically directing the deuteron beam onto and then away from the target. The lifetime was determined by measuring the decay rate of the 0.119 MeV γ-ray activity during the periods when the beam was off the target.

539.14

10037. STUDY OF SOME LEVELS OF C^{12} USING THE B^{10}(He^3,p)C^{12*} REACTIONS.

E.Almqvist, D.A.Bromley, A.J.Ferguson, H.E.Gove and A.E.Litherland.

Phys. Rev., Vol. 114, No. 4, 1040-53 (May 15, 1959).

Studies of the B^{10}(He^3,p)C^{12*}reaction using 2 MeV He^3 ions showed proton groups corresponding to levels in C^{12} at 0, 4.43, 7.65, 9.60, 10.76, 11.82, 12.78, 13.37, 14.03, 15.10, 16.10, and 16.64 MeV ± ± 0.10 MeV. The ratio $\Gamma_\gamma{:}\Gamma$ was measured to be 0.75(±0.20) for the 15.1 MeV state and 0.02(±0.01) for the 12.78 MeV state. No other alpha unstable level had a measurable $\Gamma_\gamma{:}\Gamma$; for the 7.65 MeV state a limit 0.01 is set on this ratio. The gamma-ray de-excitation of the 15.1 MeV state is both to the ground state (97%) and to the 4.43 MeV state (3.1 ± 0.6%). Only a ground state transition was observed from the 12.78 MeV level. These measurements support assignments, J, π, T of 1, +, 1 to the 15.1 level and 1, +, 0 to the 12.78 MeV state. The known properties of C^{12} are in fair agreement with the intermediate coupling shell-model calculations of Kurath. The reactions C^{13}(He^3,αγ)C^{12}(15.1 MeV) and B^{10}(He^3,d)C^{11} to the ground and first excited state of C^{11} were observed.

539.14 : 539.17

INVESTIGATION OF 16.1 MeV EXCITATION LEVEL OF C^{12}. See Abstr. 8582

539.14 : 539.17

FIRST 0$^+$-STATES IN C^{12} AND O^{16}. See Abstr. 8594

539.14

10038. ENERGY LEVELS OF B^9 AND O^{15}. B.Povh.

Phys. Rev., Vol. 114, No. 4, 1114-16 (May 15, 1959).

Energy levels of B^9 were investigated by the B^{10}(He^3,α)B^9 reaction. Alpha-particle groups leading to the ground, 2.37 MeV and 2.83 MeV states of B^9 have been found. There is no evidence for any well-defined state between the ground state and 2.37 MeV state of B^9. The O^{16}(He^3,α)O^{15} reaction was studied in the neighbourhood of 5 MeV excitation in O^{15} and excited states have been found at 5.247 and 5.195 MeV energy in O^{15}.

539.14

10039. INFERIOR EXCITED (ROTATION) LEVELS OF Th^{224}.

A.P.Komar, G.A.Korolev, and G.Kocharov.

Zh. eksper. teor. Fiz., Vol. 34, No. 5, 1345-6 (1958). In Russian. English summary: PB 141052T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The α-particle spectrum from U^{228} indicates a low-intensity transition to a level in Th^{234} at about 160 keV, in addition to the transitions to the ground and 48 keV states. The ratio of the energies of the first and second excited states is consistent with their being the 2^+ and 4^+ levels of a rotational scheme.

A.E.I. Research Laboratory

539.14 : 539.163.2

LEVELS IN Os^{190} POPULATED IN THE DECAY OF 11d Ir^{190}. See Abstr. 8533

539.14 : 539.17

ENERGY LEVELS OF Sc^{45} AND Ca^{42}. See Abstr. 8584

539.14

10040. AN INVESTIGATION OF HEAVY FRAGMENTS EMITTED FROM STARS IN NUCLEAR EMULSIONS. O.Skjeggestad.

Arch. Math. Naturvid., Vol. 54, No. 7, 98 pp. (1959).

Deals with stable, multiply-charged nuclear fragments and hyperfragments, emitted from nuclear disintegrations in photographic emulsions. A simple method by which one can determine the charge of heavy fragments with ranges $> 100\,\mu$ is described, and the variation of the track width at the end of the particle range is compared with theoretical models. The energy spectra, angular distributions and relative frequencies of the emitted fragments are determined. A detailed comparison is made with the predictions from the nuclear evaporation theory, taking into account the movement of the evaporating nucleus. The evaporation theory can hardly explain the emission of all the fragments, and some other mechanisms that may contribute to heavy fragment emission are discussed. The emission of hyperfragments is compared with the emission of stable nuclear fragments.

539.14

10041. OBSERVATIONS OF HYPERFRAGMENTS.

F.Breivik, O.Skjeggestad, S.O.Sörensen and A.Solheim.

Nuovo Cimento, Vol. 12, No. 6, 531-40 (June 16, 1959).

The disintegration of 23 hypernuclei is described, involving 7 mesonic and 16 non-mesonic decays. An event is observed which possibly represents the mesonic decay of a $^6He_\Lambda$ hypernucleus according to the scheme $^6He_\Lambda \rightarrow {}^4He + {}^2H + \pi^-$ with $B_\Lambda(^6He_\Lambda)$ $\approx 3.8 \pm 0.7)$ MeV.

539.14

10042. A RE-ANALYSIS OF THE EXPERIMENTAL DATA ON HYPERNUCLEI DECAYING BY π^- EMISSION.

R.Levi-Setti, W.E.Slater and V.L.Telegdi.

Nuovo Cimento Suppl., Vol. 10, No. 1, 68-90 (1958).

Standard procedures were adopted for the analysis of raw data from 18 laboratories. Binding energies were recalculated and are presented for 70 events.

E.J.Burge

539.14

10043. DECAY OF A BERYLLIUM HYPERFRAGMENT.

A.O.Vaisenberg and V.A.Smirnitskii.

Zh. eksper. teor. Fiz., Vol. 36, No. 1, 333-5 (1959). In Russian.

A non-mesonic decay in emulsion which yields 8.2 ± 1.6 MeV for the binding energy of the Λ^0 in the Be^8 nucleus.

W.O.Lock

RADIOACTIVITY

539.16.08

10044. A METHOD OF ESTIMATING THE CONTAMINATION OF AIR BY AIRBORNE URANIUM DUST, INDEPENDENTLY OF BACKGROUND RADIOACTIVITY. C.Cottini, E.Gatti and A.Malvicini.

Nuovo Cimento Suppl., Vol. 9, No. 2, 381-4 (1958). In Italian.

A continuously operating monitor is described which is independent of variations in the background activity of the air and which at the same time remains sufficiently sensitive. An α-active deposit is precipitated electrostatically on to a moving belt made of aluminium, which is then passed between two ZnS scintillators placed on either side. The thickness of the aluminium is chosen so as to absorb completely all uranium α-particles, but only a fraction of α-particles from RaC' representing essentially most of the activity due to decay products of emanation. Full details are given of the transitorized circuitry; high stability over long operating periods is claimed.

S.J.St-Lorant

539.1

10045. THE NATURAL RADIOACTIVITY IN GLASS.

H.Drost and H.Pupke.

Exper. Tech. der Phys., Vol. 7, No. 1, 20-6 (1959). In German.

A counter system is described which was used to measure the activity in 35 different glasses of German manufacture. Only 7 of them were without radioactivity whilst the others contained levels of K^{40} (some contained also uranium isotopes or Pb^{208}) related to the potassium content per cent. The average value was about 0.3 counts min^{-1} cm^{-2} (% potassium content)$^{-1}$.

J.R.Malla

539.16

10046. THE HALF-LIFE OF Pb^{210} (RaD).

B.D.Pate, D.C.Santry and L.Yaffe.

Canad. J. Chem., Vol. 37, No. 5, 1000-1 (May, 1959).

The half-life of Pb^{210} has been redetermined using a 4π propor tional counter and a value of 23.3 ± 0.5 years obtained.

L.L.Gree

539.1

10047. ON THE DECAY SCHEMES OF SOME ODD—ODD DEFORMED NUCLEI. L.K.Peker.

Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 2, 216-27 (1958). In Russian. English summary: PB 141041T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington D.C., U.S.A.

The decay schemes of some odd—odd nuclei leading to the nuclei Gd^{154}, Gd^{156}, Er^{168}, W^{184}, Re^{184}, U^{232}, Pu^{240} are discussed. Th experimental data are re-interpreted using the level schemes expect ed for the even—even product nuclei.

L.L.Gree

539.1

10048. STUDY OF THE DISINTEGRATION OF ERBIUM 169.

G.Charpak and F.Suzor.

J. Phys. Radium, Vol. 20, No. 5, 513-15 (May, 1959). In French.

A study has been made of the low energy electron and photon spectrum of Er^{169} by use of two proportional counters in coincidenc with sources of less than 0.5 micrograms per cm^2, vacuum evapor ated. The branching ratio to the 8.4 keV excited level of Tm^{169} is found to be (42 ± 1)%. The internal conversion coefficient is found to be $\alpha_M + \alpha_N = 106 \pm 6$.

539.1

10049. THE PROPERTIES OF BERYLLIUM-11.

D.E.Alburger and D.H.Wilkinson.

Phil. Mag. (Eighth Ser.), Vol. 3, 1332-3 (Nov., 1958).

The beta-activity of half-life 14.1 sec induced in boron by 14 MeV neutrons is confirmed as due to Be^{11} and the half-life determined as 13.57 ± 0.15 sec. The energies and log ft values for β-ray transitions to the ground state and several excited state of B^{11} have been measured. The γ-rays in coincidence with the β-rays of various energies were also observed.

L.L.Gre

539.1

10050. SEARCH FOR THE ISOTOPE Ir^{196}.

D.G.Gardner and W.W.Meinke.

Phys. Rev., Vol. 114, No. 3, 822-4 (May 1, 1959).

The isotope Ir^{196} has been reported to have a half-life of ~ 9 days and to emit β^- particles with a maximum energy of about 0.08 MeV. Using deuteron-bombarded enriched isotopes of platin it is shown that the previous mass assignment was incorrect. It suggested that the ~ 9 day activity found in deuteron bombardmen of natural platinum is due to Ir^{189} and Ir^{190} produced by the (d,n) reaction on osmium impurities. An experimental upper limit of 5 hours for the Ir^{196} half-life can be set by these experiments. Rough cross-sections for the (d,α) reaction on Pt^{194} and Pt^{196} are given for several deuteron energies from 9.6 to 20.4 MeV.

539.

10051. DECAY OF $I^{130} \rightarrow Xe^{130}$.

W.G.Smith, P.H.Stelson and F.K.McGowan.

Phys. Rev., Vol. 114, No. 5, 1345-50 (June 1, 1959).

The decay of I^{130} has been previously studied by two groups workers, and, as a result, the following level scheme for Xe^{130} ha been proposed: 528 keV (2+), 1190 keV (4+), 1930 keV (6+), and 2340 keV (5−). Only the states at 1930 keV and 2340 keV were fo to be directly populated by beta decay. However, the recent mea ment of spin 5 for I^{130} suggests that the 1190 keV state, if 4^+, sho be populated by beta decay. In the present work, such a group w looked for and not found. A lower limit of 9.8 was set for the lo ma—gamma correlations were also measured. The experi- tal correlation for 1190-528-0 level sequence can be fitted by 2(Q)0 or by 1(96% D + 4% Q) 2 (Q)0 sequences. The 2+ assign- t to the 1190 keV level requires a predominantly M1 transition the 2+ to 2+ transition in contrast to the predominantly E2 racter of other known transitions of this type. Therefore, er 4+ or 2+ assignment to the 1190 keV state leads to an anoma- situation. Six other angular correlations were measured in an mpt to determine the characteristics of the levels at 1930 keV 2340 keV. It was not possible to obtain unique assignments.

539.163

52. THE CALORIMETRIC DETERMINATION OF THE HALF- E OF Ra^{226}.

.Gorshkov, Z.G.Gritchenko and N.S.Shimanskaya.
eksper. teor. Fiz., Vol. 34, No. 3, 756 (March, 1958). ussian. English translation in: Soviet Physics—JETP (New k), Vol. 34(7), No. 3, 519-20 (Sept., 1958).

From precise calorimetric measurements on purified radium s the half life of Ra^{226} was found to be 1577 ± 9 years, which is ood agreement with that adopted by the International Commission in disagreement with recent values obtained by other workers hman, Ames and Sedlet, National Nuclear Energy Series, PPR B PII 1657 (1949), and Sebaou, Abstr. 654 of 1957].

A.E.I. Research Laboratory

539.163

53. ON THE PROBLEM OF THE DECAY SCHEME OF Ce^{144}.

.Forafontov and A.A.Sorokin.
eksper. teor. Fiz., Vol. 36, No. 1, 330-1 (1959). In Russian.

Measurements of γ—γ and e^-—γ coincidences, which yield data greement with the decay scheme put forward in a previous er [Izv. Akad. Nauk SSSR, Vol. 21, No. 12, 1601 (1957)].

W.O.Lock

539.163

54. NUCLEAR-SPECTROSCOPIC INVESTIGATIONS OF —Cd^{110} and Sb—Te^{124}. E.Boschitz.

Phys., Vol. 154, No. 1, 90-110 (1959). In German.

A detailed study of the compound energy level schemes in —Cd^{110} and Sb—Te^{124} is made. The angular correlations of ee cascade transitions are measured and spins of 2.3 and 3 igned to the 1.52 MeV level in Cd^{110}, the 2.28 MeV and 2.70 MeV els in Te^{124} respectively. The author gives a very full discussion he optimum choice of instrumentation and the coincidence circ- ry involved.

S.J.St-Lorant

539.163.1

055. LIFETIME OF THE 3.56-MeV STATE IN Li^6.

J.A.Levesque and S.M.Shafroth.
ys. Rev., Vol. 114, No. 5, 1354-7 (June 1, 1959).

An upper limit for the mean life of the 3.56 MeV state in Li^6 5 × 10^{-14} sec has been established by a Doppler shift method. is supports the 0+, T = 1 assignment for this level. It has also en established by a Doppler shift technique that the angular tribution of the recoil alphas arising from the Be^9(p,α)Li^{6*}(γ)Li^6 action is symmetric about 90° in the centre-of-mass system at resonant bombarding energy of 2.56 MeV. At 2.93 MeV bombar- g energy the angular distribution of the alphas is peaked forward 90°.

539.164

056. ELECTRON POLARIZATION IN FIRST FORBIDDEN IQUE BETA TRANSITIONS. B.Kuchowicz.

ll. Acad. Polon. Sci. Ser. Sci. math. astron. phys., Vol. 7, No. 2, -91 (1959).

A list of formulae is given for the electron polarization in coil experiments for the case of the first forbidden ($\Delta J = \pm 2$) nsitions.

S.J.St-Lorant

539.164

057. HOW VALID IS THE EXPONENTIAL LAW IN α-DECAY?

etzold.
Phys., Vol. 155, No. 4, 422-32 (1959). In German.

As a simple model of α-decay, a particle in a penetrable sphere treated and the time behaviour of the wave-function discussed. e deviations from the exponential law for very small and for very ge times cannot be experimentally observed.

539.164

10058. THE ALPHA DECAY OF CURIUM-242.

L.N.Kondrat'yev, V.B.Dedov and L.L.Gol'din.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 2, 99-100 (1958). In Russian. English summary : PB 141041T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Theoretical intensity calculations of the α-decay to the second excited level (4+) showed serious disagreement with existing experimental results in the case of Cm^{242} and Cm^{244}. The results for the former isotope were checked by using a magnetic α-spectrometer. The energies of the α-lines were measured with respect to the main peak, the energy of which was taken to be 6110 keV, a line of energy 5777 keV being attributed to Cm^{243} admixture. The disagreement with theory is confirmed and interpreted as indicating that in the case of Cm^{242} the shape of the nucleus can not be satisfactorily expressed by the formula $r(\theta) = r_0[1 + \alpha_2 P_2(\cos\theta)]$, (Abstr. 2535 of 1958), and that it is not ellipsoidal.

I.C.Demetsopoullos

539.164

10059. A NEW TERBIUM ISOTOPE OF MASS 152 — ALPHA EMITTER. J.Olkowsky, I.Gratot, M.Le Pape and L.Cohen.

Nuclear Phys., Vol. 12, No. 2, 159-66 (July (1), 1959). In French.

Produced by Eu^{151}(α,3n) and Gd^{152}(p,n) reactions. Its half-life is found to be 4 ± 0.5 min. This isotope decays by electron-capture, β^+ and α-rays. The ratio α/X_k is $\cong 2 \times 10^{-5}$. Gamma-rays of 140 and 235 keV were observed. The relative proportions of the different gamma-rays detected are: X_k, 100; 140 keV, 25; 235 keV, 30; 511 keV, 15.

539.165

10060. THE ELECTRON, POSITRON AND GAMMA SPECTRUM OF Cu^{64}. W.D.Schmidt-Ott.

Z. Phys., Vol. 154, No. 3, 286-93 (1959). In German.

The β^- and β^+ spectrum of Cu^{64} is studied using a split-crystal scintillation spectrometer. Spectra with threshold energies of E_{β^+} = (665 ± 20) keV and E_{β^-} = (580 ± 17) keV are obtained. A linear relationship is shown to exist between the photo yield of the anthracene scintillator and the energy of the incident particles — for positrons between 150 and 665 keV. The gamma transition is found to have E_γ = (1.317 ± 0.008) MeV and an intensity of N_γ/N_{β^+} = = 0.0280 ± 0.0024.

S.J.St-Lorant

539.165

10061. THE PARTIAL β-SPECTRA OF Dy^{165}.

F.Bonhoeffer, H.H.Hennies and A.Flammersfeld.
Z. Phys., Vol. 155, No. 4, 488-97 (1959). In German.

An additional line at (555 ± 5) keV is mapped in the spectrum of Dy^{165}. Using a β—γ coincidence technique all transitions leading to the 95 keV and 985 keV level are studied. Both β-spectra give straight line Fermi diagrams. The maximum energies found are (1.215 ± 0.020) MeV and (0.305 ± 0.010) MeV, and the β-transition leading to the ground state of Ho^{165} has a maximum energy of (1.305 ± 0.020) MeV. The fractional yields and the spin—parity assignments are discussed in the light of the shell model.

S.J.St-Lorant

539.165

10062. THE DECAY OF Tb^{160} AND Ho^{160} AND THE LEVEL SCHEME OF Dy^{160}. E.P.Grigor'yev, B.S.Dzhelepov, A.V.Zolotavin, O.E.Kraft, B.Kratsik and L.K.Peker.

Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 2, 101-25 (1958). In Russian. English summary : PB 141041T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Internal conversion, β-ray and γ-ray spectra of Tb^{160}, obtained by slow-neutron irradiation of chemically pure Tb_2O_3, were investigated using a double focusing β-spectrometer. The position and relative intensities of 19 lines in the conversion spectrum are presented in tabular form. It was found that the known line 964 keV can be resolved into two components, 963 and 966 keV. The relative intensities of the γ-lines in the photoelectron spectrum agree to within ±20% with existing results (Abstr. 4272 of 1958). In the conversion spectrum of Ho^{160}, obtained by 660 MeV proton irradiation of a Ta target and subsequent chromatographic separation of the erbium and holmium fractions, many new lines were discovered in addition to confirming already known ones. It is shown that the transitions to the upper levels are permitted ones and that at the low decay-energy, K-capture predominates over positron decay.

A table of the multiplicity of transitions is given. The proposed level scheme for Dy^{160} was compiled by the use of all available experimental data, theoretical considerations, and by analogy with the behaviour of neighbouring nuclei. A critical discussion of the scheme is given. I.C.Demetsopoullos

539.165

10063. DEVIATION FROM THE ξ APPROXIMATION IN FIRST FORBIDDEN β DECAY. T.Kotani.

Phys. Rev., Vol. 114, No. 3, 795-806 (May 1, 1959).

The failure of the ξ approximation in which only the first non-vanishing term is kept in the expansion in descending powers of the Coulomb energy factor is due to either the cancellation or selection rule effect. The latter may be due to K or j forbiddennesses. In order to distinguish these three possibilities experimentally, the two transitions, $3(\beta)2(\gamma)0$ and $2(\beta)2(\gamma)0$,are discussed. The present data on Sb^{124} and Rb^{86} are insufficient to permit drawing a definite conclusion. Similar arguments can be extended to other β decays. To get more information, the general energy and angular dependences are given in convenient form for various observables, and are shown numerically for Sb^{124}. Certain $\beta-\gamma$ correlation experiments, especially the β-circularly polarized γ correlation and the transverse β polarization, are proposed for a variety of special β decays, e.g., Ga^{72}, Y^{92}, and so on. It is also concluded that the unique shape energy spectrum does not necessarily correspond to a unique forbidden transition. An example is Eu^{152}. Measurements of $\beta-\gamma$ correlations are useful in order to decide this correspondence. Other β decays, which may be characterized by the cancellation, are Ag^{111}, Re^{186}, and Tm^{170}.

539.165

10064. FORMULAS OF ALLOWED BETA DECAY. M.Morita.

Phys. Rev., Vol. 114, No. 4, 1080-1 (May 15, 1959).

The corrections due to the relativistic matrix elements are given for the various formulae describing all phenomena of allowed beta decay. It is shown that without explicit calculation one can derive these corrections from the formulae for the first forbidden transitions, which have been published in many papers. It is suggested that a generalization of the present work to the higher forbidden transitions can be made.

539.165

10065. β-DECAY MATRIX ELEMENTS IN STRONGLY DEFORMED NUCLEI. G.Alaga.

Period. math.-phys. astron. (Zagreb), Vol. 12, No. 4, 245-56 (1957).

A calculation of β-decay matrix elements, taking into account collective motion of the nuclei. Bohr—Mottelson wave-functions are used, together with the individual nucleon wave-functions given by Nilsson (Abstr. 3526 of 1957). Numerical results are not stated. J.C.Taylor

539.165

10066. SEARCH FOR DOUBLE β-DECAY IN Ca^{48}.

E.I.Dobrokhotov, V.R.Lazarenko and S.Yu.Luk'yanov.

Zh. eksper. teor. Fiz., Vol. 36, No. 1, 76-87 (1959). In Russian.

The apparatus, method and control experiments employed in the investigation are described. It is concluded that if double β-decay exists in Ca^{48}, its half-life must not be smaller than 0.7×10^{19} yr.

539.165

10067. PROBABILITY OF DOUBLE β-DECAY. F.Yanoukh.

Zh. eksper. teor. Fiz., Vol. 36, No. 1, 335-7 (1959). In Russian.

Double β-decay is discussed terms of the standard five invariant interactions. Possible decay schemes and selection rules are discussed for: Ca^{48}, Zr^{96}, Te^{130}, Cd^{116} and Sn^{124}. An ft value of approximately 10^7 is assigned for the double β-decay of Ca^{48}. J.W.Gardner

539.165

10068. 0− TO 0+ BETA TRANSITION $Pr^{144} \rightarrow Nd^{144}$.

F.T.Porter and P.P.Day.

Phys. Rev., Vol. 114, No. 5, 1286-96 (June 1, 1959).

The Argonne double-lens beta-spectrometer and associated coincidence circuit were used. The validity of the spin and parity assignment 0− to Pr^{144} is supported by a measurement of the shape of the (1.2 ± 0.1)% abundant 2.3 MeV beta-transition, observed in coincidence with the 697 keV gamma-ray. Its shape is that of the unique ($\Delta I = 2$, yes) first-forbidden transition expected if the transition goe from 0− Pr^{144} to the 2+ first excited state of even—even Nd^{144}. The shape of the (1.0 ± 0.1)% abundant 807 ± 5 keV beta-transition to th 2.19 MeV level in Nd^{144} was observed in coincidence with the 1.49 and 2.19 MeV gamma-rays. Its allowed shape is consistent with a 0− assignment for Pr^{144}. With this assignment the transition betwe the ground states is a 0− to 0+ case. The shape of this 2996 ± 3 keV 97.8% abundant transition was obtained from the total spectrum by small subtractions of the inner groups. Its nearly allowed shape i easily explained with a pure axial vector shape factor; in contrast, the tensor-pseudoscalar formalism fails to reproduce the shape. The ratio of axial vector matrix elements $\lambda = (i\int\gamma_5/\int\sigma.r)$ can be determined from the shape; the present data give $\lambda = 5 \pm 2$. This i the same absolute magnitude as some theoretical estimates but has the opposite sign. The present experimental results are in good agreement with those of Graham, Geiger and Eastwood (Abstr. 1733 of 1959) who have already pointed out that this 0− to 0+ transition does not offer a sensitive measure of the relative size of pseudoscalar to axial vector coupling constants although the net relative contribution of the direct pseudoscalar part to the whole AP shape factor must be $<\sim 1\%$ (with Rose—Osborne formalism). An inciden al result of the present work is that the $H\rho$ of the K-conversion line of the 133.5 keV transition following the β-decay of Ce^{144} has been measured as 1064.8 ± 0.6 Gauss.

539.16

10069. ON THE 0-0 β-TRANSITIONS WITH CHANGE OF PARITY

B.V.Geshkenbein.

Zh. eksper. teor. Fiz., Vol. 34, No. 5, 1349-50 (May, 1958). In Russian. English summary: PB 141052T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

It is pointed out that the form of the spectrum in 0-0 β-transitions with change of parity agrees well with the prediction of an axial vector interaction, thus supporting the hypothesis that the β-decay interaction is V and A. Expressions are given for the polarization of the electrons and for the electron-neutrino angular correlation, in decays of this type. E.J.Squire

539.16

10070. STUDY OF THE K CAPTURE—POSITRON RATIO OF THE TRANSITION I^{126} (2−) → Te^{126} (2+). D.S.Harmer and M.L.Perlman

Phys. Rev., Vol. 114, No. 4, 1133-8 (May 15, 1959).

The relative probabilities of K-electron capture and of positron emission were measured for the transition of I^{126}(2−) to th first excited state of Te^{126}(2+). Direct measurement by a triple-coincidence method of the K/β^+ ratio gave the value 145 ± 4. The energy of the positron transition to the ground state (2− → 0+) was found to be 1.129 ± 0.005 MeV. The energy of the inner positron transition was determined to be 0.459 ± 0.007 MeV by subtraction the measured energy of the first-excited state of Te^{126}, 0.670 ± 0.005 MeV, from the ground-state-transition energy. The K/β^+ ratio of the 2− → 2+ transition and the ratios for analogous transitions occurring in As^{74} and Rb^{84} are compared with ratios com puted from a model based on shell considerations. Measurements were made also of the two higher energy positron spectra of I^{124}; th end-point energies were found to be 2.136 ± 0.010 MeV and 1.53 ± 0.02 MeV.

539.16

10071. RATIO OF THE GAMOW—TELLER AND FERMI COUPLING CONSTANTS DETERMINED FROM ft VALUES.

O.C.Kistner and B.M.Rustad.

Phys. Rev., Vol. 114, No. 5, 1329-32 (June 1, 1959).

A comparison is made of the ratios of the squares of the Gamow—Teller and Fermi coupling constants, ${C_{GT}}^2/{C_F}^2$, calculat from the latest experimental ft values and the theoretical matrix elements for the "doubly closed shell ± one nucleon" mirror transitions and the 0^+-0^+ transitions. The ft value of the neutron derive from the recent half-life measurement of 11.7 ± 0.3 minutes leads to a value for ${C_{GT}}^2/{C_F}^2$ of 1.42 ± 0.06, which is in agreement with the ratio obtained from the correlation coefficient for the beta-particle momentum and the spin direction of the decaying neutron. The ft value for the decay of H^3 is also in good agreement with thi ratio if the Gamow—Teller matrix element for this transition does not differ appreciably from that predicted by the individual particle model. The ft value of the heavier mirror nuclei, O^{15}, F^{17} and Ca^{39}, are consistent with a considerably lower ratio. In particular O^{15} and F^{17}, for which the Gamow—Teller matrix elements are considered the most reliable because the magnetic moments of the ghter nuclei are especially close to the Schmidt limits, lead to a ue for C_{GT}^2/C_F^2 of 1.16 ± 0.05. These results are consistent n recent theoretical considerations which suggest that meson hange effects may give rise to appreciable corrections in the culation of the matrix elements.

539.165

72. ON THE PROOF OF THE ABSENCE OF NORMALIZATION OF THE CONSTANT IN THE VECTOR RIANT OF THE β-INTERACTION. B.L.Ioffe.

eksper. teor. Fiz., Vol. 34, No. 5, 1343-5 (May, 1958). In sian. English summary : PB 141052T-2, obtainable from Office Technical Services, U.S. Dept. of Commerce, Washington, D.C., .A.

Verifies explicitly the statement of Feynman and Gell-Mann str. 507 of 1958), that there is no renormalization of the coupling stant associated with the vector part of the β-interaction if re is a conservation law for the corresponding current density.

P.K.Kabir

539.165 : 539.12

ASPECTS OF β^- AND β^+ DECAYS. See Abstr. 9921

539.165 : 539.12

LONGITUDINAL POLARIZATION OF POSITRONS FROM THE CAY OF O^{14}. See Abstr. 9940

539.166 : 539.14

73. RESONANCE SCATTERING OF γ-QUANTA ON Mg^{24}.

.Delyagin and V.C.Schpinel'.

l. Akad. Nauk SSSR, Vol. 121, No. 4, 621-2 (1958). In Russian.

β-recoil from gaseous radioactive Na^{24} is used to compensate Doppler effect for the ensuing γ-ray from Mg^{24*} (1.37 MeV level). ng the S-variant of β-interaction, the γ-spectrum is calculated. sonance scattering gives then a life-time for Mg^{24*} $\tau = (1.7 \pm 0.4)$ 0^{-12}. If this level is interpreted as a rotational level, one ains a rather large value for the deformation parameter, namely, 0.6.

J.Lascoux

539.166

74. γ-SPECTRUM OF La^{140}.

P.Prikhodtseva and Yu.V.Khol'nov.

. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 2, 176-8 (1958). In ssian. English summary : PB 141041T-2, obtainable from Office Technical Services, U.S. Dept. of Commerce, Washington, D.C., S.A.

The γ-spectrum of La^{140} has been re-examined using improved solution. New lines were found at 868 ± 5 and 2343 ± 15 keV th possible others with energies of 400, 643, 903 and 2890 keV.

C.J.Batty

539.166

75. ON THE DECAY OF Rh^{106}.

P.Grigor'ev, A.V.Zolotavin, I.I.Kuz'min and E.D.Pavlitskaya.

. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 2, 194-7 (1958). In ssian. English summary : PB 141041T-2, obtainable from Office Technical Services, U.S. Dept. of Commerce, Washington, D.C., S.A.

Investigation of the radiation accompanying the decay $^{106} \rightarrow Rh^{106} \rightarrow Pd^{106}$ using a double focussing β-spectrometer. The and L conversion lines of the 513 and 623 keV transitions from ^{106} were measured. In an investigation of the photo-electrons from γ-spectrum of Rh^{106}, electrons corresponding to the 513, 623 and 52 keV γ-transitions were found. No photo peaks were found rresponding to γ-transitions in the 100-400 keV range.

C.J.Batty

539.166

076. HARD γ-RADIATION FROM As^{76}. THE As^{76} DECAY HEME. L.V.Gustova and O.V.Chubinskii.

eksper. teor. Fiz., Vol. 35, No. 6(12), 1369-79 (1958). Russian.

Six γ-lines with energies of 1.21, 1.43, 1.76, 2.08, 2.42 and 65 MeV were observed and their relative intensities were determined and found to be ~ 500, ~ 54, 37, 100, 5.7, 4.6, respectively. e decay scheme of As^{76} is discussed. It is suggested that the llowing excited levels exist in Se^{76}: 0.56 MeV (2^+); 1.21 MeV (2^+); 76 MeV (1.2^+); 2.07 MeV (1.2^+); 2.42 MeV (2.3^+); 2.64 MeV (3^+). is also suggested that levels with energies ~ 1.02 MeV and 1.26 MeV (0^+ or 4^+) may exist.

539.166

10077. HARD γ-RADIATION FROM Na^{24}.

L.V.Gustova, B.S.Dzhelepov, P.F.Ermolov and O.V.Chubinskii.

Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 2, 211-15 (1958). In Russian. English summary : PB 141041T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The γ-rays from Mg^{24} following β decay of Na^{24} have been examined. The β decay of Na^{24} to the 5.23 MeV state in Mg^{24} which subsequently decays by γ-ray emission of a 3.85 MeV energy is confirmed. There is some discussion of the spin of the 5.23 MeV state.

L.L.Green

539.166 : 539.14

10078. STUDY OF Ho^{166}. L.Grenacs and A.Meessen.

J. Phys. Radium, Vol. 20, No. 1, 61-2 (Jan., 1959). In French.

Two γ-cascades have been observed: 630-360 keV and 210-710 keV. For the 360 keV level, the lifetime is reported to be greater than 2.5 × 10^{-7} sec. Angular correlation data are reported for the second cascade.

J.Lascoux

539.166

10079. GAMMA RAY SPECTROSCOPY OF Mn^{54}.

T.Katoh, M.Nozawa, Y.Yoshizawa and Y.Koh.

J. Phys. Soc. Japan, Vol. 13, No. 12, 1419-20 (Dec., 1958).

Internal-conversion electrons of the 0.84 MeV gamma-ray were measured by a two-directional focusing beta-ray spectrometer. It was determined that $E\gamma = 837.9 \pm 0.3$ keV and $K/(L+M) = 8.5 \pm 0.7$. No gamma-ray was observed.

539.166

10080. NEUTRON CAPTURE GAMMA-RAYS OF IODINE, IRIDIUM AND CERIUM.

R.Balzer, H.Knoepfel, J.Lang, R.Müller and P.Stoll.

Nuovo Cimento, Vol. 11, No. 4, 609-11 (Feb. 16, 1959).

n,γ spectra of I, Ir and Ce have been determined using a pair-spectrometer above 3 MeV and a grey-wedge spectrometer below 3 MeV. Using the pair-spectrometer from a target of pure iodine 8 lines were identified between 5.57 MeV and 6.71 MeV. Using 40 g Ir, 8 lines between 5.34 and 6.08 MeV were identified. Using the grey-wedge spectrometer calibrated by Cs^{137}, 10 lines between 38 and 1170 keV were seen, one due to annihilation and two tentatively thought to be X-rays. Six lines were observed between 75 and 652 keV using an iodine sample, one being an X-ray from the collimator (75 keV) and one due to annihilation (501 keV). Two of the lines at 435 and 652 keV are thought to be due to neutron inelastic scattering.

A.E.I. Research Laboratory

539.166 : 539.14

10081. THE LEVEL SCHEME OF ^{136}Ba.

R.K.Girgis and R.van Lieshout.

Nuclear Phys., Vol. 12, No. 2, 204-17 (July (1), 1959).

The gamma-radiation following the decay of C^{136} was investigated using a scintillation spectrometer. The energies of the various gamma-rays are in good agreement with the values reported by Olsen and O'Kelley (Abstr. 11368 of 1954); the relative intensities were also determined. Gamma—gamma coincidences were performed using a conventional fast—slow coincidence set-up; they were also studied by the summing technique. A decay scheme consistent with these results is proposed; it consists of levels at 830, 1900, 2090, 2170, 2240, 2330, 2430 and 2490 keV. The decay of La^{136}, which also leads to levels in Ba^{136}, was investigated. Only one gamma-ray of 830 keV was found with certainty, thus confirming that the first 2^+ level in Ba^{136} has this energy.

539.166

10082. ILLUSTRATION OF THE DEPENDENCE OF THE SIGN OF δ OF A MIXED GAMMA-RAY TRANSITION ON ITS ORDER IN A CASCADE. S.Ofer.

Phys. Rev., Vol. 114, No. 3, 870-1 (May 1, 1959).

An analysis of the angular correlation functions obtained for γ-ray cascades following the decay of Tb^{156} (5 day) illustrates that different signs of δ (defined as the ratio, in a mixed transition, of the reduced matrix element corresponding to multipole order L + 1 to that corresponding to multipole order L) have to be used in a case where a γ-ray with mixed multipolarities is the first component of a cascade and in a case where the same γ-ray is the second component of a cascade investigated if the formulae and tables of Biedenharn and Rose (1953) are used for the analysis of the angular correlations.

539.166

10083. γ-TRANSITIONS BETWEEN CORRESPONDING STATES IN MIRROR NUCLEI. G.Morpurgo.
Phys. Rev., Vol. 114, No. 4, 1075-80 (May 15, 1959).

It is shown that charge independence or charge symmetry give rise to the following relations connecting the strengths of γ-transitions between corresponding states in mirror nuclei: (a) the strengths of corresponding E1 transitions are always equal; (b) the strengths of corresponding M1 transitions should not differ in general by more than a factor 1.5; (c) for transitions with $|\Delta T| = 1$ the strengths of corresponding transitions of any multipolarity are equal. The effects of the Coulomb and exchange corrections to the above rules are examined. The experimental data presently available are discussed.

539.166

10084. ON THE THEORY OF INTERNAL CONVERSION. I. V.A.Krutov.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 2, 162-70 (1958). In Russian. English summary : PB 141041T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The effects of higher order terms in the perturbation theory of internal conversion are re-examined, and it is found that they are of more importance than has previously been assumed. In particular, the validity of the conclusions of Coish (Abstr. 512 of 1952) is questioned. E.J.Squires

539.166

10085. ON THE THEORY OF INTERNAL CONVERSION. II. V.A.Krutov and K.Myuller.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 2, 171-5 (1958). In Russian. English summary : PB 141041T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The corrections produced by higher approximations of perturbation theory are discussed, and it is concluded that for low-energy transitions of high multiple order the corrections may be very large. A.E.I.Research Laboratory

539.166

10086. INTERNAL CONVERSION COEFFICIENTS FOR L_I, L_{II}, L_{III} LEVELS. M.Frilley and M.Valadares.
J. Phys. Radium, Vol. 20, No. 1, 60-1 (Jan., 1959). In French.

A comparison is made of the relative intensities L_I/L_{II}, L_{II}/L_{III} for the γ emitted in the transformation RaD → RaE, with the theoretical values given by Sliv and Band, and by Rose. It is summarized as follows:

L_I/L_{II}	9.5 ± 0.4	10.5 (Rose)	9.3 (Sliv)
L_{II}/L_{III}	10.5 ± 0.9	10.4	11.7

The authors point out that the experimental errors for L_{II}/L_{III} has possibly been underestimated. J.Lascoux

539.166

10087. ANOMALOUS INTERNAL CONVERSION COEFFICIENT OF 29 keV RADIATION FROM Pa^{234} (UX_2). R.Foucher.
C.R. Acad. Sci. (Paris), Vol. 248, No.12, 1800-3 (March 23, 1959). In French.

The internal conversion coefficient α_L for the 29 keV γ-ray of Pa^{234} was measured using a spectrometer in a coincidence circuit. The value 60 ± 10 was found and this result is briefly discussed. C.J.Batty

539.166

10088. THE CONVERSION SPECTRUM OF LA^{140}.
A.A.Bashilov, B.S.Dzhelepov, N.D.Novosil'tseva, L.S.Chervinskaya.
Izv. Akad. Nauk. Ser. fiz., Vol. 22, No. 2, 179-90 (1958). In Russian. English summary: PB 141041T-2, obtainable from Office of Technical Services, U.S. Dept of Commerce, Washington, D.C., U.S.A.

The conversion spectra for transitions in Ce^{140} following decay from La^{140} have been observed using a magnetic spectrograph. 28 conversion lines corresponding to 16 transitions were observed and this K/L conversion coefficient ratio obtained for a large number of these transitions. A decay scheme for Ce^{140} is produced. L.L.Green

539.166

10089. Gd^{146} AND Eu^{146} CONVERSION ELECTRON SPECTRA.
N.M.Anton'eva, A.A.Bashilov, B.S.Dzhelepov and B.K.Preobrazhensk
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 28-31 (1959). In Russian.

Conversion electrons corresponding to three nuclear transitions with energies of 114.8, 115.5 and 155 keV have been observed in the case of Gd^{146}, and to two transitions with energies of 630 and 742 keV in the case of Eu^{146}. Decay schemes are proposed.

539.166

10090. ON THE 100 keV TRANSITION IN THE Ce^{144} SPECTRUM.
A V.Gnedich, L.N.Kryukova and V.V.Murav'eva.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 329 (1959). In Russian.

A study using a spiral beta-spectrometer with 0.25% resolution. The energy of the transition was found to be 99.7 ± 0.1 keV, and the ratio of the K and L conversion coefficients $\alpha_K/\alpha_L = 3.3 \pm 0.8$, whic corresponds to an M3 transition. W.O.Lock

NUCLEAR REACTIONS

539.17

10091. DETERMINATION OF NUCLEAR REACTION MECHANISMS FROM ENERGY SPECTRA OF EMITTED PARTICLES.
B.L.Cohen and A.G.Rubin.
Phys. Rev., Vol. 114, No. 4, 1143-5 (May 15, 1959).

Energy spectra of deuterons and tritons from (p,d) and (p,t) reactions are found to be peaked near their maximum energy, in contrast to the spectra of protons from (d,p) and (t,p) reactions whic are peaked at low energy. It is shown that this characteristic of inverse reactions is to be expected from "stripping" and "pickup" reactions as a consequence of the fact that the former excite "particle" states while the latter excite "hole" states, but that it is not expected from collision type reaction mechanisms (e.g. "knock-out"). It is thus concluded that (t,p) and (p,t) reactions as well as (d,p) and (p,d) reactions proceed by "stripping" and "pickup". The shape of energy spectra from (p,α) and (α,p) reactions indicates that the non-compound-nucleus portion of these also goes by "pick-up" and "stripping"; there is corroboratory evidence for this from absolute cross-sections.

539.17

10092. THEORY OF DIRECT-INTERACTION INELASTIC SCATTERING. N.K.Glendenning.
Phys. Rev., Vol. 114, No. 5, 1297-1311 (June 1, 1959).

A model is proposed for the description of direct-interaction inelastic scattering in which resolved final states of the target nucleus are observed. This model is expected to be useful in deducing the spins and parities of the excited states of nuclei.

539.17

10093. POLARIZATION OF NUCLEONS AND RESIDUAL (PRODUCT) NUCLEI IN STRIPPING REACTIONS.
H.A.Weidenmüller.
Z. Phys., Vol. 153, No. 4, 440-4 (1959). In German.

Under the usual assumptions of nuclear stripping theory, it is shown that the proportionality constant connecting the polarization of outgoing particles and of residual nucleus is determined by the quantum numbers of the initial and final states of the nucleus only. Therefore, a simultaneous measurement of both quantities provides a sensitive test of the validity of those assumptions without the necessity of detailed numerical calculations. The well-known theoretical properties of the nucleon polarization ($|P_{nucl}| \leq \frac{1}{3}$, P_{nucl} positive or negative, if $j = l + \frac{1}{2}$ or $j = l - \frac{1}{2}$) do not hold for the nuclear polarization, the sign of which is independent of j and which may assume the value one.

539.17

10094. THE THREE α-DISINTEGRATION OF C^{12}. J.Yoccoz.
C.R. Acad. Sci. (Paris), Vol. 248, No. 7, 952-4 (Feb. 16, 1959). In French.

Alpha-model for C^{12} is used to interpret the reaction

$$p + C^{12} \rightarrow 3\alpha + p'$$

for high energy protons. Introducing the scattering matrix $p-\alpha$, Born approximation matrix elements are written down. For high energy α, exchange terms are neglected; a partial comparison wit some experimental results is finally made. J.Lascou

539.17

95. SCATTERING OF FAST NUCLEONS BY THE C^{12} NUCLEUS HE α-PARTICLE MODEL. J.L.Picou.
Acad. Sci. (Paris), Vol. 248, No. 23, 3272-4 (June 8, 1959).
rench.

Using the α-particle model and the impulse approximation, the ss-section, polarization and asymmetry in p—C^{12} scattering are ted to those in p—α scattering. The results are compared with eriment and with independent-particle model predictions.
R.J.N.Phillips

539.17

96. ELASTIC SCATTERING OF 5.7 MeV PROTONS FROM Cr AND Ti.
ondo, T.Yamazaki, A.Toi, R.Nakasima and S.Yamabe.
hys. Soc. Japan, Vol. 13, No. 3, 231-3 (March, 1958).

Using 5.7 MeV protons from the cyclotron, the angular ributions of protons elastically scattered from Fe, Cr and Ti e investigated by means of nuclear emulsion technique. The ılar distributions of the elastically scattered protons by these ei were similar to that of Ni, that is, the differential crossions in the ratio to those of the Rutherford scattering increase arly at large angles. Some qualitative arguments are given about characteristic feature of these nuclei, together with previously sured elements Ni and Zn.

539.17

97. POLARIZATION OF 6- AND 7-MeV PROTONS ASTICALLY SCATTERED BY NUCLEI.
.Warner and W.P.Alford.
s. Rev., Vol. 114, No. 5, 1338-44 (June 1, 1959).

Polarization measurements have been made by first scattering n the target of interest and second scattering in a carbon polarier for which the mean second scattering angle is 48° and for ch the mean value of the polarization is greater than +70% for $E_2 \leq 6$ MeV. The polarization as a function of angle at 15° rvals from 45° to 135° is reported near 6 MeV for Al, Ti, V, Cr, Co, Ni, Cu, and Zn, and near 7 MeV for Al, Fe, Ni, and Cu.) usually shows an oscillatory behaviour, with the magnitude of maxima and minima never greater than about 40%. The polarion as a function of energy is reported for C at 45° from 5.7 to MeV, and for Fe and Cu at 60° and 120° from 5.8 to 6.4 MeV. C, P(45°) decreases from +92% at 5.7 MeV to +36% at 6.8 MeV. Cu, P(60°) and P(120°) vary slowly, if at all, with energy, but a id energy variation for Fe is observed, possibly due to resonance cts in compound elastic scattering.

539.17

98. PROTON ELASTIC SCATTERING CROSS-SECTIONS OF Cl, K, Sc, Ti, AND Mn. S.Rubin, L.E.Bailey and T.O.Passell.
s. Rev., Vol. 114, No. 4, 1110-14 (May 15, 1959).

The proton elastic scattering yields of silicon, chlorine, assium, scandium, titanium, and manganese have been determined respect to that from copper in the energy range 1.0-2.0 MeV at laboratory angle. Two large resonances were found in silicon two smaller ones in chlorine. The smooth regions of the curves not vary significantly from the Rutherford values.

539.17

99. SCATTERING OF PROTONS BY Ne^{20} AND Ne^{22}.
da, M.Takeda, C.Hu and S.Kato.
hys. Soc. Japan, Vol. 14, No. 4, 396-402 (April, 1959).

The angular distributions of protons scattered elastically and lastically by Ne^{20} and Ne^{22} have been observed at six energies m 4.95 to 5.50 MeV. The shape of angular distribution of inelastlly scattered protons varies rapidly with incident energy in both es of Ne^{20} and Ne^{22}. An anomaly is found at 5.25 MeV in the reon $Ne^{20}(p,p')Ne^{20}$ (Q = –1.63 MeV). The elastic scatterings also ibit the corresponding features. These results suggest that the ction proceeds mainly through the compound nucleus formation cess. The spin and parity of the compound state seem likely to 5/2(+).

539.17

00. QUASI-ELASTIC SCATTERING OF FAST NUCLEONS BY HT NUCLEI. N.Bessis.
. Acad. Sci. (Paris), Vol. 248, No. 15, 2168-70 (April 13, 1959).
rench.

Quasi-elastic scattering differential cross-sections for (p, pn) (p,2p) are evaluated for protons with 155 and 340 MeV energies. torted wave-functions are used. But only the differential crosstions for detecting a single nucleon are given. J.Lascoux

539.17

10101. ANGULAR DISTRIBUTION OF PROTONS INELASTICALLY SCATTERED FROM Mg^{24}. S.Yamabe.
J. Phys. Soc. Japan, Vol. 13, No. 3, 237-40 (March, 1958).

The angular distributions of protons inelastically scattered from Mg^{24} (Q = –1.368 MeV) were measured from 22.5° to 165° in the laboratory system at incident proton energies of 5.1 and 5.4 MeV. The 44 in. Osaka University cyclotron was used to provide a proton beam, and the scattered protons were detected by nuclear emulsion technique. Both distributions obtained show an asymmetry about the centre-of-mass scattering angle $\theta = 90°$ and a strong dependence with the energy of primary protons.

539.17

10102. ELASTIC AND INELASTIC SCATTERING OF 14.1 MeV PROTONS BY MEDIUM WEIGHT NUCLEI.
K.Kikuchi, S.Kobayashi and K.Matsuda.
J. Phys. Soc. Japan, Vol. 14, No. 2, 121-8 (Feb., 1959).

The absolute differential cross-sections for the elastic scattering and the inelastic scattering (proceeding to the first excited state) of 14.1 MeV protons were measured for Ni, Fe, Cr and Ti with a 5° (or less) interval ranging from 20 to 165°. The scattered protons were detected by NaI(Tl) scintillation counter whose energy resolution was about 2.3%. Even at small angles the protons inelastically scattered could be discriminated from those elastically scattered. The angular distribution of inelastic protons agreed with that expressed by $|j_2(qR)|^2$, the theoretical prediction based upon the Born approximation.

539.17

10103. DETERMINATION OF (p,n) REACTION THRESHOLDS OF Ru ISOTOPES. C.Lévi, L.Papineau, C.Redon-Latapie and N.Saunier.
C.R. Acad. Sci. (Paris), Vol. 248, No. 19, 2749-51 (May 11, 1959).
In French.

Thresholds have been measured for the isotopes Ru^{99}, Ru^{101}, Ru^{102}, and Ru^{104}. The variation of the mass differences of the isobares Ru—Rh is compared with that of Mo—Tc. J.Lascoux

539.17

10104. THE NEUTRON YIELD FROM HEAVY ICE TARGETS BOMBARDED WITH PROTONS BELOW THE D(p,n)2p THRESHOLD. P.P.Singh, G.M.Griffiths, Y.I.Ssu and J.B.Warren.
Canad. J. Phys., Vol. 37, No. 7, 866-73 (July, 1959).

In connection with some experiments on the gamma-ray yield from the $D(p,\gamma)He^3$ reaction using heavy ice targets a considerable yield of neutrons was found even for proton bombarding energies well below the D(p,n)2p threshold of 3.3 MeV. The yield, excitation function, and angular distribution of this neutron yield were investigated both experimentally and by means of theoretical calculations. These studies confirm the suggestion that the neutrons are produced by a secondary reaction in which deuterons, scattered in the target by incident protons, collide with further target deuterons to produce $D(d,n)He^3$ reactions.

539.17

10105. SPALLATION OF TERBIUM BY 170 MeV PROTONS. I. QUALITATIVE.
J.Olkowsky, M.Le Pape, I. Gratot and L.Cohen.
J. Phys. Radium, Vol. 20, No. 5, 549-56 (May, 1959). In French.

The products of the reaction were studied by radiochemical methods. For each element, α, β, γ, and X-rays have been studied and results compared to literature data. A new alpha-emitter of gadolinium of half-life 7 hr was observed, with the following γ-rays: X (43 keV), 220 keV, 340 keV, 550 keV, 720 keV. New γ-rays are given: Tb^{155}: 480 keV, 880 keV. Eu^{147}: 570 keV. Eu^{146} (38 hr) : 125 keV; 570 keV. Eu^{145}: 180 keV.

539.17

10106. GAMMA RAYS FROM THE PROTON BOMBARDMENT OF SILICON. E.Okada, I.Miura, T.Wakatsuki and Y.Hirao.
J. Phys. Soc. Japan, Vol. 13, No. 6, 541-4 (June, 1958).

The gamma-ray spectrum from silicon bombarded by 5.7 MeV protons was studied by a scintillation spectrometer. The following gamma rays due to inelastic scattering of protons were observed: 1.78 MeV (Si^{28} 1st-ground), 1.28 MeV (Si^{29} 1st-ground), 2.03 MeV (Si^{29} 2nd-ground), 2.43 MeV (Si^{29} 3rd-ground), 2.24 MeV (Si^{30} 1st-ground). Excitation curves for the 1.78 MeV gamma rays have been measured in the proton energy range from 2.2 to 5.7 MeV. Resonances were found at 2.9, 3.5, 4.4, 5.0 and 5.4 MeV. At 5.4 MeV, the angular distribution of the 1.78 MeV gamma rays was measured. By comparison with theory, the corresponding compound level of P^{29} at 7.9 MeV was assigned $d_{5/2}$. The cross-section for this process is 250 mb.

539.17

10107. ENERGY DEPENDENCE OF THE (p, n) REACTION NEAR A = 70.

G.A.Jones.

Nuclear Phys., Vol. 12, No. 2, 167-81 (July (1), 1959).

Measurements for elements near the size-resonance in the proton strength function have been made. It is shown that the (p, n) reaction is not always a good measure of the total reaction cross-section. The measurements made confirm that the size-resonance is for s-wave protons and that a radius $R = 1.45\ A^{1/3} \times 10^{-13}$ cm is suitable for computation of barrier penetrabilities; if a rounded potential well is used to represent the nuclear interaction, they limit the variation of parameters used in the description of the well.

539.17

10108. DIRECT RADIATIVE CAPTURE OF PROTONS BY O^{16} AND Ne^{20}.

N.Tanner.

Phys. Rev., Vol. 114, No. 4, 1060-4 (May 15, 1959).

A study has been made of the $O^{16}(p,\gamma)F^{17}$ and $Ne^{20}(p,\gamma)Na^{21}$ reactions by counting the positron activities of F^{17} and Na^{21} following proton bombardment of oxygen and neon targets. The $O^{16}(p,\gamma)F^{17}$ cross-section was measured at a proton bombarding energy of 616 keV to be 0.29 ± 0.03 microbarns and the $Ne^{20}(p,\gamma)Na^{21}$ cross-section was measured at 1100 keV to be 1.3 ± 0.7 microbarns. These cross-sections are consistent with the reaction process in each case being one of direct radiative capture. In addition, the energy dependence of the $O^{16}(p,\gamma)F^{17}$ cross-section from 275 to 616 keV was also consistent with the direct-capture hypothesis. Both of these reactions are believed to be important at the thermal energies effective in stars. For such energies the cross-section parameter S_0 was estimated to be $S_0 = 5 \pm 1$ keV-barns for $O^{16}(p,\gamma)F^{17}$, and $S_0 \sim 80$ keV-barns for $Ne^{20}(p,\gamma)Na^{21}$.

539.17 : 539.163

10109. NUCLEAR SPECTROSCOPY OF ODD-MASS (161-173) NUCLIDES PRODUCED BY PROTON IRRADIATION OF Er AND Yb.

B.Harmatz, T.H.Handley and J.W.Mihelich.

Phys. Rev., Vol. 114, No. 4, 1082-94 (May 15, 1959).

To study the effect of nucleon number on nuclear levels of odd-mass rare-earth isotopes, enriched isotopes of Er and Yb were irradiated with protons in the ORNL 86 inch cyclotron. After chemical separation, the decay chains leading to stable isotopes were analysed with internal-conversion, photographic-recording, permanent-magnet spectrographs. Precise energy values as well as photometrically measured intensities of conversion lines of 8 to 1600 keV energy were obtained. Very light isotopes of Lu and Tm, each eight mass units from the mass stability line, were produced. The following activities were studied: Tm^{161} (~ 30 min), Ho^{161} (E3, 211 keV), Tm^{163} (2 hr), and Lu^{167} (54 min), all previously unreported, as well as Tb^{161}, Ho^{161}, $Tm^{165,167}$, Yb^{167}, $Lu^{169,171,173}$, Hf^{173}, and possibly Yb^{169m}. Genetic relationships and partial level schemes for decay chains of masses 151 to 173 are shown. Where comparison is possible, excellent agreement with the predictions of Mottelson and Nilsson is obtained, particularly for the case of the various isotopes of Tb, Ho, and Tm, where striking similarities in the level structure are observed.

539.17

10110. GAMMA RAYS FROM THE 1.83 MeV RESONANCE IN THE REACTION $Mg^{24}(p,\gamma)Al^{25}$.

A.E.Litherland, H.E.Gove and A.J.Ferguson.

Phys. Rev., Vol. 114, No. 5, 1312-19 (June 1, 1959).

This reaction was studied in the range of proton energies from 1.66 to 2.02 MeV. A new resonance at 1.833 ± 0.007 MeV was observed which corresponds to an excited state of 4.047 ± 0.010 MeV in Al^{25}. The new excited state was observed to decay by the emission of 4.01 ± 0.04, 2.43 ± 0.04, and 1.62 ± 0.03 MeV gamma-rays. The last two gamma-rays were observed to be in coincidence and the intensity ratio of the first two gamma-rays was found to be 60 ± 10 : 40 ± 10. The experimental value of $\omega\gamma = (J + \frac{1}{2})\Gamma_p\Gamma_\gamma/\Gamma$, for the ground state transition was found to be 3×10^{-3} eV and an upper limit of 10 keV was estimated for Γ the total width of the resonance. Angular distribution measurements have shown that the angular momentum of the new state is either $\frac{5}{2}$ or $\frac{9}{2}$ with the latter value favoured. On the basis of the observed dipole-quadrupole admixtures found for the gamma-rays the parity of the new state is probably even. A discussion is given of the place of the new state in the rotational-like bands of Al^{25}.

539.17

10111. REACTION $T(p,n)He^3$ FOR PROTONS OF ENERGY 7-12 MeV.

G.F.Bogdanov, N.A.Vlasov, S.P.Kalinin, B.V.Rÿbakov, L.N.Samoilo and V.A.Sidorov.

Zh. eksper. teor. Fiz., Vol. 36, No. 2, 633-6 (Feb., 1959). In Russian.

Angular distributions are given for $E_p = 6.8$, 8.9 and 12 MeV, as well as the dependence of the total cross-section on the energy. A strong backwards anisotropy indicates an important interference between two compound states with different parity. J.Lascou

539.17

10112. YIELDS AND ANGULAR DISTRIBUTIONS OF PROTONS FROM $F^{19}(d,p)F^{20}$ AND $F^{19}(d,p)F^{20*}$.

K.Ôno, J.Shimada, K.Kuroda, O.Tanaka, H.Kamitsubo, A.Ito, S.Tanaka and M.Imaizumi.

J. Phys. Soc. Japan, Vol. 14, No. 2, 117-20 (Feb., 1959).

The reactions were studied with deuteron energies from 1.3 to 2.0 MeV. Angular distributions of protons leaving F^{20} in the 0.65 MeV excited state show a pronounced peak at about 60° over the entire deuteron energy range. Those leaving F^{20} in the ground state vary with the deuteron bombarding energy, and most of them show no peak in the forward direction and a large peak in the backward direction. The absolute yields of the reactions were measure at $\theta_{cm} = 54^\circ$ and $\theta_{cm} = 104^\circ$ as functions of the bombarding energy. A marked difference in the energy dependence of the yields for the two reactions is noted. The yield for $F^{19}(d,p)F^{20}$ at $\theta_{cm} = 104^\circ$ show a broad maximum centred at about 1.70 MeV deuteron energy; that from $F^{19}(d,p)F^{20*}$ at $\theta_{cm} = 54^\circ$ shows a slow increase with increasin deuteron energy. The results show that, at these energies, $F^{19}(d,p)F^{20}$ seems to proceed mostly by compound nucleus formatio and $F^{19}(d,p)F^{20*}$ (0.65 MeV) seems to be caused by the stripping process of d neutrons.

539.1

10113. ELASTIC SCATTERING OF DEUTERONS FROM Mg, Al, Ti, V, Cr, Co, Ni, and Cu.

I.Slaus and W.P.Alford.

Phys. Rev., Vol. 114, No. 4, 1054-60 (May 15, 1959).

Angular distributions of deuterons elastically scattered from Mg, Al, Ti, V, Cr, Co, Ni, and Cu have been measured at laborator energies of 3.32 and 4.07 MeV. The measured cross-sections show a smooth decrease below the Rutherford cross-section for scatterin angles greater than some critical angle which increases with increasing A and decreasing deuteron energy. Cross-sections calculated with an optical model show satisfactory agreement with the measurements. The dominant feature of the model is the large imaginary part of the potential, implying strong absorption of deuterons interacting with the nucleus. From the measurements, however, it does not appear possible to identify the reaction mechanism giving rise to this absorption.

539.1

10114. INELASTIC SCATTERING CROSS-SECTIONS OF 4.5 MeV DEUTERONS ON SOME LIGHT NUCLEI.

E.A.Romanovskii and G.F.Timushev.

Zh. eksper. teor. Fiz., Vol. 34, No. 5, 1350-1 (1958). In Russian. English summary : PB 141052T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Deuterons of energy from 4 to 4.5 MeV were scattered inelastically by nuclei of Li^7, F^{19}, Na^{23}, Mg^{24} and Al^{27}. The differential cross-section was determined, using a magnetic analyser to separate the groups, and its value compared with the theoretical values of the differential $d\sigma_{E_2}/d\Omega$ and total cross-sections σ_{E_2} of Coulomb excitation in levels in F^{19}, Na^{23} and Mg^{24}. The contribution of the calculated σ_{E_2} to the experimental cross-section is small, of the order of a few per cent, and from this the authors concluded that at a deuteron bombarding energy of 4 to 4.5 MeV an above the Coulomb excitation of the nuclei cannot be the predominant process leading to inelastic scattering of the deuterons. A.E.I. Research Laborato

539.1

10115. RESONANCE OF F^{18} BY BOMBARDING O^{16} WITH DEUTERONS.

G.López, F.Alba, M.Mazari and M.E.Ortiz.

Rev. Mexicana Fis., Vol. 8, No. 1, 17-26 (1959). In Spanish.

Important differences from the results predicted by the Butler theory have been observed in angular distributions of the $O^{16}(d,p)C$ reaction, particularly when the incident deuteron energy is near 1.7 MeV. In this neighbourhood, the formation of the compound

eus F^{18} from the fusion of O^{16} and H^2 is possible. To deter-
e the position of this resonance, three series of exposures were
e (using a magnetic spectrograph), measuring the intensity of
on groups, with a known solid angle,as a function of the bombard-
energy. The deflector and spectrograph magnetic fields were
en so that the first excited state of O^{17} remained on the same
position in the whole series of exposures, and that the ground
of O^{17} and the elastic groups of C^{12} and O^{16} were recorded
ltaneously. A constant number of elastic deuterons of O^{16} was
n as a reference, and the other intensities were corrected
rdingly. A F^{18} resonance is established at a 1.65 ± 0.03 MeV
barding energy, which corresponds to a level of F^{18} at
MeV. This also confirms, with somewhat better approximation,
result reported previously at 9.0 MeV.

539.17

6. $B^{11}(He^3,p)C^{13}$ AND $B^{11}(He^3,d)C^{12}$ REACTIONS.

.Holmgren, E.A.Wolicki and R.L.Johnston.
s. Rev., Vol. 114, No. 5, 1281-5 (June 1, 1959).

For previous work on light nuclei, see Abstr. 2626, 6569, 5613,
l of 1957; 1967 of 1958. The differential cross-sections for the
He^3,p)C^{13} and the $B^{11}(He^3,d)C^{12}$ reactions were measured at 4.5
5.4 MeV. Yield curves for these reactions were also obtained
the energy region extending from 3.00 to 5.40 MeV. The An-
r distributions for the deuteron groups are strongly peaked in
forward direction and indicate that the simple stripping interac-
is the predominant mechanism of these reactions. The angular
ributions of the proton groups are more complex and more dif-
lt to interpret; however the yield curves change rather slowly
energy suggesting that direct interaction mechanisms may be
ortant.

539.17

17. ON THE COLLECTIVE DESCRIPTION OF THE GIANT
ONANCE. G.Monsonego.

. Acad. Sci. (Paris), Vol. 248, No. 11, 1623-5 (March 16, 1959).
rench.

It is suggested that the force acting on the centre-of-charge
nucleus can be approximated by an harmonic force, the
ngth being given by an expression involving the double com-
ator of the exact Hamiltonian with the momenta of the particles.

J.Lascoux

539.17

18. NOTE ON THE ELECTRIC QUADRUPOLE ABSORPTION
THE NUCLEAR PHOTO-REACTION. S.Fujii and O.Sugimoto.

vo Cimento, Vol. 12, No. 6, 513-22 (June 16, 1959).

The behaviour of the EQ absorption cross-section in the giant
onance region is discussed through the analysis of the angular
ributions of emitted particles by using the direct interaction
del. The difference between proton and neutron angular distribu-
is attributed to the difference between the effective charges of
proton and the neutron for EQ radiation. The excitation func-
s for the EQ absorption are computed for $A^{40}(\gamma,p)Cl^{39}$ and
$^9(\gamma,p)Fe^{58}$. It is pointed out that the integrated cross-sections for
EQ absorption are favourable to explain the feature of the angu-
distributions and the excitation curves have a peak near the maxi-
n energy of the giant resonance. The agreement between these
ults and experiments for the angular distributions of the above re-
ons is good in part. On the whole, however, the ratio of the ED
he EQ absorption cross-section is too small in comparison with
required from the experiments. The results of this model are
ely discussed and the direction of the modification is also indi-
ed.

539.17

19. NUCLEAR PHOTON ABSORPTION IN CARBON AND
YGEN. A.S.Penfold and E.L.Garwin.

s. Rev., Vol. 114, No. 5, 1324-8 (June 1, 1959).

The importance of narrow, isolated, resonances in the photo-
lear absorption cross-sections of C and O was investigated by
ans of an absorption experiment performed with 30.7 MeV
msstrahlung. The experiment yielded values for the cross-
tions averaged over the (γ,n) cross-sections for C^{12} and O^{16}.
results for C were the same as those expexted for a cross-
tion without narrow resonances, while for O a definite resonance
ct was demonstrated. The O photonuclear absorption cross-
tion, averaged over the $O^{16}(\gamma,n)O^{15}$ cross-section, was found to
26.7 ± 3.5 millibarns, 16 ± 4 millibarns higher than the value
ected if narrow resonances contribute insignificantly. Esti-
ed values for the parameters of the O resonances near 22 MeV are: average peak height, 106 ± 14 mb; ratio of the radiative width (to ground state) to total width, $(6.6 \pm 0.9) \times 10^{-3}$; total width about 30 keV. The experimental results are insensitive to uncertainties in the non-nuclear X-ray attenuation cross-sections for C and O.

539.17

10120. PHOTOPROTON CROSS-SECTIONS OF CARBON.

S.Penner and J.E.Leiss.
Phys. Rev., Vol. 114, No. 4, 1101-9 (May 15, 1959).

The partial (γ,p) cross-section of carbon in which the residual boron nucleus is left in the ground state was measured with a thin-crystal proton spectrometer. This cross-section is shown to decrease from about 10 mb at the giant resonance peak (22 MeV) to about 0.1 mb near 60 MeV photon energy. Angular distributions measured at five energies exhibit an asymmetry around 90° which increases rapidly with increasing energy. The partial cross-section to the first excited state of boron is (7 ± 16)% of the ground-state cross-section. The partial cross-section to one or more excited states of boron about 5 MeV above the ground state is comparable with the ground-state cross-section above 30 MeV photon energy. In addition to the cross-section data, the measurements provide a sensitive means of calibrating the energy scales of electron accelerators at energies in the 25 to 50 MeV region.

539.17

10121. PHOTONUCLEAR CROSS SECTIONS FOR A^{40}.

A.S.Penfold and E.L.Garwin.
Phys. Rev., Vol. 114, No. 4, 1139-42 (May 15, 1959).

The (γ,p), (γ,np), (γ,n), and $(\gamma,2n)$ cross-sections for A^{40} are presented. The (γ,p) cross-section has a peak at 23.5 MeV while the (γ,n) cross-section peaks at 16.5 MeV and the $(\gamma,2n)$ peaks at 20 MeV. The (γ,np) cross-section peaks at 27.5 MeV. The total absorption cross-section for A^{40} has a peak height of 86 mb at 23.5 MeV and a full width at half maximum of 10.3 MeV. The integrated total cross-section is 470 ± 70 mb-MeV to 23 MeV and 900 ± 180 mb-MeV to 40 MeV. The shapes of these cross-sections are discussed and a need for further investigation of energy and angular distributions of photoprotons from argon is indicated.

539.17

10122. PRECISION MEASUREMENT OF THE $Be^9(\gamma,n)$ CROSS SECTION. J.H.Gibbons, R.L.Macklin, J.B.Marion and H.W.Schmitt.

Phys. Rev., Vol. 114, No. 5, 1319-23 (June 1, 1959).

Measurements were made of the photoneutron cross-section for Be^9 using γ-rays from radioactive sources of Y^{88} (1.85 MeV) and Sb^{124} (1.69 MeV). The values obtained at these two energies are $(6.54 \pm 0.31) \times 10^{-28}$ cm^2 and $(12.62 \pm 0.69) \times 10^{-28}$ cm^2, respectively. The limiting factors in the accuracy of these measurements are the uncertainties in the γ-ray source strength calibration and in the N.B.S. No. 2 Ra—γ—Be neutron source standard, and the lack of precise knowledge concerning the Sb^{124} decay scheme. A new measurement of the γ-ray branching ratios in the Sb^{124} decay has also been made.

539.17

10123. ANALYSIS OF PHOTONUCLEAR CROSS SECTIONS.

A.S.Penfold and J.E.Leiss.
Phys. Rev., Vol. 114, No. 5, 1332-7 (June 1, 1959).

The problem of obtaining a photonuclear cross-section from a yield curve measured with a bremsstrahlung beam is discussed.

539.17

10124. NOTE ON THE PHOTODISINTEGRATION OF THE DEUTERON. W.Zernik, M.L.Rustgi and G.Breit.

Phys. Rev., Vol. 114, No. 5, 1358-60 (June 1, 1959).

The differential cross-section $\sigma(\theta,\phi)$ and proton polarization $P(\theta,\phi)$ have been computed at γ-ray energies of 22.5, 32.8, 64.4, 107.8, 164.5, and 193.9 MeV. The nuclear force potential was a slightly modified form of that used by Signell and Marshak. In order to test recent claims regarding comparison with experiment not calling for the inclusion of effects of retardation and exchange currents, these effects have been neglected. The influence of the inclusion of different multipoles has been studied by employing successive approximations in which the transitions which are unimportant at low energies are introduced in turn. The inclusion of M1 transitions to triplets and of E2 effects has left discrepancies of several times the experimental error with data on σ at 65 and 108 MeV. The relative largeness of the effects of the transitions just mentioned at the higher energies complicates the employment of the photoeffect as a means of obtaining evidence regarding the nucleon—nucleon interaction.

539.17

10125. THE THEORY OF THE PHOTODISINTEGRATION OF THE DEUTERON IN THE MIDDLE ENERGY REGIONS.

B.Banerjee, G.Kramer and L.Krüger.
Z. Phys., Vol. 153, No. 5, 630-42 (1959). In German.

Assuming the validity of Siegert's theorem, the differential cross-section for the photodisintegration of the deuteron is calculated on phenomenological grounds for energies up to 80 MeV. The Hulthén wave-function with a 4% D-state admixture is used for the ground state. The final state potential is approximated by a square well of given radius and having a depth calculated from phase-shifts given by Marshak, with the addition of a hard core of radius 0.4 fermis. Only electric and magnetic dipole transitions are considered; the isotropic term leads to a reasonably constant value in agreement with the experimental energy-dependence but about 20% smaller than the experimental value. Good agreement is obtained for the $\sin^2\Theta$ coefficient. S.J.St-Lorant

539.17

10126. THEORY OF THE FORWARD ASYMMETRY IN THE PHOTODISINTEGRATION OF DEUTERONS.

B.Banerjee and G.Kramer.
Z. Phys., Vol. 154, No. 5, 513-23 (1959). In German.

The forward asymmetry in the differential cross-section for the photodisintegration of the deuteron has been calculated on the basis of a phenomenological theory for energies up to 80 MeV. The formulae for this asymmetry, which come from the E1—E2 and M1—M2 interference, are given, assuming the validity of Siegert's theorem. The E2 and M2 amplitudes are calculated approximately, using the Hulthen wave-function with a 4% D-state admixture for the ground state and scattered waves determined by the phase shifts given by Marshak for the final states. The contribution of the M1—M2 interference turns out to be unimportant for the asymmetry, the E1—E2 interference giving the main effect. In the differential cross-section,

$$d\sigma/d\Omega = a + b \sin^2\theta + c \cos\theta + d \cos\theta \sin^2\theta,$$

a very low value for c is obtained and the ratio c/d is approximately equal to a/3b. This is in contradiction to the assumption c/d = a/b made in the previous analysis of the experimental data. This ratio seems to be insensitive to the value of the D-state admixture. For the lower energies E_γ = 10 MeV and E_γ = 20 MeV the theoretical values for "d" are in agreement with the experimental ones. For the energies 54 and 80 MeV, a comparison is made of the theoretical differential cross-section $d\sigma/d\Omega$, taking into account the values for "a" and "b", obtained in a former work (see preceding abstract), with the measured $d\sigma/d\Omega$.

539.17

10127. PHOTODISINTEGRATION OF THE Li^6 NUCLEUS.

F.Däublin, F.Berthold and P.Jensen.
Z. Naturforsch., Vol. 14a, No. 3, 208-11 (March, 1959). In German.

The cross-section of the $Li^6(\gamma,d)He^4$ reaction is found to be 7.3×10^{-31} cm² ± 50% at 2.20 MeV, and 2.5×10^{-32} cm² ± 50% at 2.76 MeV γ-ray energy. The width of the 2.188 MeV level of Li^6 is calculated to be 3×10^{-5} eV. The results are discussed in the light of the single-particle model, as well as in intermediate-coupling theory. S.J.St-Lorant

539.17

10128. THE PHOTODISINTEGRATION OF TANTALUM.

R.W.Parsons and L.Katz.
Canad. J. Phys., Vol. 37, No. 7, 809-14 (July, 1959).

The cross-section for the absorption of photons by Ta^{181} was deduced from measurements of the neutrons emitted when tantalum is irradiated in the X-ray beam of a 22 MeV betatron. The cross-section has well-defined peaks at 12.75 ± 0.25 and 15.25 ± 0.25 MeV, and from this the intrinsic electric quadrupole moment is deduced to be 5.7 ± 1.3 barns.

539.17

10129. THE $Be^9(n,2n)$ REACTION AT A NEUTRON ENERGY OF 3.7 MeV. R.Wagner and P.Huber.

Helv. phys. Acta, Vol. 31, No. 2, 89-116 (1958). In German.

It is found that the structure of the neutron spectrum indicates that the reaction proceeds by an excited state of Be^9. The differential cross-section at 90° to the incident neutron beam, in the laboratory system, at 3.7 MeV incident energy is calculated to be σ_{diff} = (39 ± 8) mb/sterad. The neutrons are produced by the d–d reaction using a rotating D_2O-ice target, and the beam is taken at right-angles to the plane of rotation. The proton recoils in Ilford C2 nuclear emulsion serve as detector. S.J.St-Lorant

539.17 : 537.311 3

10130. SOME CONSEQUENCES OF THERMAL NEUTRON CAPTURE IN SILICON AND GERMANIUM. H.C.Schweinler.

J. appl. Phys., Vol. 30, No. 8, 1125-6 (Aug., 1959).

The average value of the kinetic energy of recoil following thermal neutron capture and subsequent gamma-ray emission is 780 eV in silicon and 180 eV in germanium. For very neutron captured in silicon, 0.04 P^{31} atom (therefore, 0.04 excess electron) are formed by radioactive decay. For every neutron captured in germanium, 0.098 As^{75}, 0.012 Se^{77} (therefore, 0.122 excess electro and 0.304 Ga^{71} atom (therefore, 0.304 excess hole) are ultimately formed, in this time sequence. Analysis of an experiment of Cleland on the decay of irradiated n-type germanium gives 0.8 electron removed from the conduction band per initially recoiling germanium atom.

539.1

10131. CROSS SECTIONS FOR THE $Li^7(n,\gamma)Li^8$ REACTION.

W.L.Imhof, R.G.Johnson, F.J.Vaughn and M.Walt.
Phys. Rev., Vol. 114, No. 4, 1037-9 (May 15, 1959).

The neutron radiative capture cross-section of Li^7 was measu for neutron energies between 40 and 1000 keV and at thermal energ The reaction was detected by observing the beta decay of Li^8 in a natural LiI crystal exposed to a flux of monoenergetic neutrons. T cross-sections for the $Li^7(n,\gamma)Li^8$ reaction were obtained relative t the known cross-sections for the $Li^6(n,t)He^4$ and the $I^{127}(n,\gamma)I^{128}$ reactions which also took place in the crystal. The $Li^7(n,\gamma)$ cross-section decreases from a value of 50×10^{-6} barns at 40 keV to 5×10^{-6} barns at 1000 keV. A maximum in the cross-section was found at 250 keV, corresponding to a known level in Li^8 at 2.28 Me The observed radiation width of this level was 0.07 ± 0.03 eV.

539.1

10132. γ-RAYS FOLLOWING THERMAL NEUTRON CAPTURE I TITANIUM.

J.W.Knowles, G.Manning, G.A.Bartholomew and P.J.Campion.
Phys. Rev., Vol. 114, No. 4, 1065-74 (May 15, 1959).

The γ-rays following thermal neutron capture in titanium were studied with two high resolution spectrometers and with an angular correlation arrangement using two sodium iodide scintillation spec trometers. The high resolution instruments were a pair spectromete for the energy range 2.8 to 11.0 MeV and a double flat crystal diffraction spectrometer for the energy range 0.14 to 5 MeV. A total of 54 γ-rays were observed, 25 of which had not previously been resolved. A decay scheme for Ti^{49} is given with energy levels at 1.378 ± 0.001, 1.583 ± 0.001, 1.719 ± 0.001, 3.172 ± 0.002, and 3.261 ± 0.005 MeV. The neutron binding energy of Ti^{49} is concluded to be 8.132 ± 0.006 MeV. Angular correlation measuremen were made between some of the prominent γ-rays emitted in the decay of Ti^{49}. The measurements confirm that the spins of the 1.378 and 1.719 MeV levels are $\frac{3}{2}$ and $\frac{1}{2}$, respectively.

539.

10133. SELF-INDICATION RESONANCE NEUTRON EXPERIMENTS WITH SILVER (2-200 eV). J.E.Draper.

Phys. Rev., Vol. 114, No. 4, 1124-32 (May 15, 1959).

A method is given for the area analysis of resonance neutron self-indication experiments including consideration of the effects energy resolution, wing area, energy dependence of neutron flux, v^{-1} term in the capture cross-section, potential scattering, detaile treatment of Doppler broadening, and scattering events preceding capture in the detector sample. The essential result of this meas ment alone is nearly the peak total cross-section of the Doppler b ened resonance (viz., $\sigma_{t_0}\Psi_0/\Psi_0^{1/3}$) which with approximate knowledg of Γ gives σ_{t_0}. Experimental results are given for eleven resonan below 200 eV in silver, and they are compared with results obtaine by other methods.

539.

NUCLEAR REACTIONS DUE TO COSMIC RAYS. See also the Section entitled "COSMIC RAYS".

539.

10134. PHASE SHIFTS FOR n-He^4 SCATTERING.

P.Marin and Bang Vo-Xuan.
C.R. Acad. Sci. (Paris), Vol. 248, No. 9, 1316-19 (March 2, 1959). In French.

Phase shifts $S_{1/2}$, $P_{1/2}$, $P_{3/2}$ were measured for six values of t neutron energy between 6.4 and 6.9 MeV. They agree with theoretical values from Dodder and Gammel (Abstr. 1689 of 1953). J.Lasc

539.17

35. THE OCCURRENCE OF (n,3n) REACTIONS IN A NUCLEAR ACTOR. T.A.Eastwood and J.C.Roy.

ad. J. Phys.,Vol. 37, No. 7, 815-26 (July, 1959).

The reactions $Bi^{209}(n,3n)Bi^{207}$ and $Au^{197}(n,3n)Au^{195}$ were ob-ved to occur in NRX, a thermal neutron reactor. Competing re-ons leading from Bi^{209} or Au^{197} to the same products were shown e negligible. Within the uncertainties of the methods used the ds of Bi^{207} and Au^{195} are about those expected on the basis of tron evaporation from the compound nucleus formed by the amal-ation of the incoming neutron and the target nucleus.

539.17

36. EVIDENCE FOR NEUTRONS WITH AN ENERGY OF 3 MeV IN THE NRX REACTOR. J.C.Roy.

ad. J. Phys., Vol. 37, No. 7, 827-31 (July, 1959).

Experimental evidence is presented on the occurrence of the $(n,2n)C^{11}$ reaction in the NRX reactor. The probability of occur-ce of the competing processes $C^{12}(\gamma,n)C^{11}$ and $C^{12}(p,pn)C^{11}$ is cussed. A comparison is made of the observed reaction rate with one predicted by the formula representing the energy distribution he prompt neutrons from the thermal fission of U^{235}. Since the eshold of the $C^{12}(n,2n)C^{11}$ reaction is 20.3 MeV, observation of reaction in the NRX reactor means that there are neutrons with energy of at least 20.3 MeV produced in fission.

539.17

37. MEASUREMENT OF THE MEAN NUMBER OF PROMPT UTRONS FROM THE FISSION OF PLUTONIUM-239 INDUCED 14.2 MeV NEUTRONS. J.Leroy.

R.Acad. Sci. (Paris), Vol. 248, No. 7, 954-6 (Feb. 16, 1959). French.

The ratio of the number of prompt neutrons per fission induced 14.2 MeV neutrons in Pu^{239}, to that induced by the same energy trons in U^{238}, has been measured as 1.045 ± 0.08. Discrimination ainst Pu^{239} fissions not induced by the 14.2 MeV neutron beam was ieved by selecting only those which occurred in coincidence with α-particles, emitted simultaneously with the neutrons from the T) source. Combining the above value with the previously deter-ned number of prompt neutrons per fission of U^{238}, the number fission of Pu^{239} was determined as 4.75 ± 0.4.

A.E.I. Research Laboratory

539.17

138. PRECISE DETERMINATION OF THE U^{233} FISSION UTRON SPECTRUM.

B.Smith, P.R.Fields, R.K.Sjoblom and J.H.Roberts.

ys. Rev., Vol. 114, No. 5, 1351-3 (June 1, 1959).

The U^{233} prompt fission neutron spectrum is measured. Fast ne of flight techniques are employed to study the neutron energy stribution from 0.3 to 5.0 MeV. Proton recoil emulsions are lized for neutron measurements from 1.2 to 7.0 MeV. The perimentally determined fission neutron spectrum is expressed the form:

$$N(E) = \{a_0 + a_1E + a_2E^2\}\phi(E),$$

ere E is the neutron energy in MeV, N(E) is the number of U^{233} sion neutrons per unit energy interval, $\phi(E)$ is the U^{235} prompt sion neutron spectrum, and a_0, a_1, and a_2 are constants normalized give agreement with the known average number of U^{233} prompt sion neutrons. The average energy of the U^{233} prompt fission utrons calculated from the experimental results is 1.87 ± 0.04 MeV.

539.17

139. DEVELOPMENTS IN PHYSICS.

V.Dunworth, D.J.Littler and J.Walker.

Brit. Nuclear Energy Conf., Vol. 4, No. 2, 85-96 (April, 1959).

Reviews and assesses the developments in, and highlights the portant aspects of, reactor physics, which emerged at the cond United Nations International Conference on the Peaceful es of Atomic Energy (Geneva, 1958).

539.17

140. THE WIGNER RELEASE IN GRAPHITE MODERATED ACTORS. I. PHYSICAL INTERPRETATION OF THE WIGNER ERGY AND ANNEALING PROCESSES. II. THEORY AND PERIMENTS ON THE ANNEALING OF THE MODERATOR.

Dalmasso and G.F.Nardelli.

ergia nucleare, Vol. 6, No. 5, 307-21 (May); No. 6, 376-92 ne, 1959). In Italian.

The phenomenological theory of annealing by processes with a distribution of activation energies is found to be satisfactory. The Wigner release is studied with some typical boundary conditions and for certain thermal perturbations. Experiments on the subject are reviewed and some predictions made for high-temperature reactors.

L.Pincherle

539.17 : 537.525

10141. THE POSSIBILITY OF ION RUNAWAY IN ZETA.

A.Gibson.

Nature (London), Vol. 183, 101-2 (Jan. 10, 1959).

The calculations of George (Abstr. 1788 of 1959) are inapplicable because they ignore electron—ion collisions. The conditions imposed by such collisions are discussed in detail. R.S.Pease

539.17

10124. THERMAL DESIGN CRITERIA FOR PRESSURIZED-WATER REACTORS.

W.M.Jacobi, J.D.Roarty, N.C.Sher, K.M.Treadwell and J.E.Zerbe.

Nucleonics, Vol. 16, No. 11, 130-4, 199 (Nov., 1958).

Experiments at the Bettis Plant on boiling heat transfer at 2000 lb/in^2 have established design criteria for water cooled reactors. Equations are given enabling the heat flux leading to "burnout" i.e. the point at which nucleate boiling gives way to bulk boiling followed by film boiling and overheating of fuel elements, to be calculated. The theoretical values are compared with experiment and the error in calculating the burnout point estimated.

R.D.Smith

539.17

10143. FIRST DETAILS OF A.I.'S EPITHERMAL Th BREEDER.

R.J.Beeley.

Nucleonics, Vol. 16, No. 11, 162, 164, 166 (Nov., 1958).

A proposal for a sodium cooled reactor with a core of Th—U alloy rods and a blanket of Th or ThO_2 rods moderated with graphite or Be. Variation of neutron yield (η) and fission product absorption cross-section with energy shows that this reactor with a spectrum in the 1-10^4 eV range should have a breeding ratio greater than one. Build-up of Pa^{233} in the core may be a disadvantage. R.D.Smith

539.17

10144. FLUX FLATTENING IMPROVES OUTPUT.

M.F.Duret and W.J.Henderson.

Nucleonics, Vol. 16, No. 11, 168, 170, 172, 174, 176, 178, 180 and 182 (Nov., 1958).

Calculations are made for a large heavy water power reactor with a light water reflector, showing how the power output is affected by loading the central section of the core with a lattice of a different spacing from that in the outer annulus. As a result of this method of flux flattening power may be increased by 28% and the fuel loading decreased by 14%, though the neutron leakage is increased by 18%.

R.D.Smith

539.17

10145. THE APPR ZERO-POWER EXPERIMENTS. J.W.Noaks.

Nucleonics, Vol. 16, No. 12, 51-4 (Dec., 1958).

Using the actual APPR1 fuel elements, core structure and control rod devices mounted in a 2500 gal tank, measurements were made at low power. These included critical loading, reactivity calibrations, flux distribution and the effect of steel reflectors.

R.D.Smith

539.17 : 539.12

TRANSMISSION OF NEUTRONS IN MULTILAYERED SLAB GEOMETRY. See Abstr. 9956

539.17 : 539.12

NUMBER OF ELASTIC COLLISIONS IN A FINITE LETHARGY INTERVAL. See Abstr. 9957

539.17

10146. INJECTION INTO THERMONUCLEAR MACHINES USING BEAMS OF NEUTRAL DEUTERIUM ATOMS IN THE RANGE FROM 100 keV TO 1 MeV. G.Gibson, W.A.S.Lamb and E.J.Lauer.

Phys. Rev., Vol. 114, No. 4, 937-40 (May 15, 1959).

Injection into a steady magnetic mirror machine by ionization of a beam of neutral deuterium atoms is analysed. If the neutral beam is switched on in a sufficiently good vacuum, then the trapped plasma density will build up to a steady-state value of interest for experimental study.

539.17 : 532.5 : 538.3

SELF-CONSISTENT FIELD CALCULATIONS RELEVANT TO THE PROPOSED THERMONUCLEAR MACHINE "ASTRON". See Abstr. 9865

ATOMS

539.18

10147. ON A NEW CLASSIFICATION OF THE ELEMENTS.

R.Aynard.

C.R. Acad. Sci. (Paris), Vol. 248, No. 15, 2165-7 (April 13, 1959). In French.

Describes a new form of periodic chart in which the elements are plotted on a helicoidal surface according to their electronic structure and their magnetic susceptibilities. Atomic numbers up to 113 are accommodated. J.Hawgood

539.18

10148. ORIGIN OF ALTERNATIONS IN ELECTRONEGATIVITY.

B.Lakatos.

Naturwissenschaften, Vol. 46, No. 11, 373-4 (1959).

A discussion of the origin of a difference between Pauling electronegativity values and those obtained from thermodynamic properties and from nuclear quadrupole and nuclear magnetic resonance. The alternations within a group of elements is explained in terms of variations in electron distribution and in nuclear shielding factors. J.G.Powles

539.18

10149. PHASE-SHIFTS IN THE STATISTICAL THEORY OF ATOMS

T.Tietz.

Ann. Phys. (Leipzig), Folge 7, Vol. 3, No. 1-2, 105-12 (1959). In German.

Using both the Born and the asymptotic Wentzel—Kramers—Brillouin approximation, closed expressions are derived for the phases of the coherent scattering of electrons on the Thomas—Fermi and Hartree atom. The obtained numerical results indicate that for small orbital angular momentum quantum numbers the Born approximation differs somewhat from the asymptotic W.K.B. method. Further, it is shown how one can calculate the relativistic correction for the phases in the Born and W.K.B. approximation respectively. P.Roman

539.18

10150. ON CORRELATION CORRECTIONS TO THE HARTREE—FOCK EQUATION. L.Ya.Kobelev.

Fiz. Metallov. i Metallovedenie, Vol. 6, No. 5, 943-5 (1958). In Russian.

Starting from a Green's function, a more general form of the Hartree—Fock equation is derived. A.F.Brown

539.18

10151. ON CORRELATION EFFECTS IN TWO-ELECTRON ATOMS. D.A.Kirzhnits.

Optika i Spektrosk., Vol. 5, No. 5, 485-9 (1958). In Russian.

The true interactions between particles differ from those given by the self-consistent field method. The difference (known as the correlation correction) between the exact value of energy and that given by the self-consistent field approximation is calculated in the present paper for the case of a two-electron atom or ion in its ground state. A.Tybulewicz

539.18

10152. NATURAL LINE WIDTH FOR TRANSIENT EXCITATIONS.

G.Breit and M.H.Hull,Jr.

Astrophys. J., Vol. 129, No. 2, 456-67 (March, 1959).

The absorption of a photon by a material system with four participating levels A, B, C, D, is studied with special attention to the case in which the levels are the result of combining excitations of separate systems from a → a' and from b → b' with the identification of A, B, C, and D, with (a,b), (a,b'), (a',b), and (a',b'), respectively. The absorption width of the BD transition is shown to approach the limit expected for the decoupled system as the parameters corresponding to the decoupled condition are made to approach their special values. It is similarly shown how the formulae for rescattering by the general system approach those for the decoupled system. It is found that the procedure of folding the radiation widths of upper and lower levels in a radiation transition in order to obtain the width of an absorption or emission line has to be used with care, the circumstances entering the excitation of the levels needing consideration. Correlations in photon magnitudes in double-photon emission and absorption enter some of the considerations. The consideration of the double-photon emission solution is used as an illustration of the role of the ratio of the strength of coupling between electrons to the natural line width.

539.

10153. MULTIPLE COHERENT SCATTERING OF OPTICAL RESONANCE RADIATION. APPLICATION TO THE 6 $^3P_1$ LEVEL OF MERCURY. I. THEORETICAL STUDY. J.P.Barrat.

J. Phys. Radium, Vol. 20, No. 5, 541-8 (May, 1959). In French.

Imprisonment of optical resonance radiation leads to perturbations in lifetime measurements of atomic excited states (narro ing of magnetic resonance lines observed by the double resonance method). In this first paper, a formalism is developed to account for the effect of the radiation field on the atomic excited states. applying this method to the case of a single atom, one finds the we known results concerning single scattering. In the case of two atoms, the equations obtained for the time variation of the probability amplitudes of the excited states are coupled by coefficients which are seen to represent the transmission of the excitation fro one atom to another by means of an optical photon (multiple scatte ing).

539.

10154. THE USE OF THE ASSOCIATED LAGUERRE FUNCTION IN THE METHOD OF CONFIGURATIONAL INTERACTION.

E.Holøien.

K. Norske Vidensk. Selsk. Forhandl., Vol. 31, No. 2, 6-13 (1958 ; publ. 1959).

Reviews the properties of this complete set of radial function and gives the results of computations on the ground states of He-like ions and of Li, comparing the efficiency of a 20-parameter ca culation on the former system with that of the Hylleraas 22-parameter function. J.Hawgo

539

10155. CALCULATION OF THE EIGENFUNCTIONS OF 4f-ELECTRONS AND DETERMINATION OF THE COEFFICIENTS OF OPERATOR EQUIVALENTS. N.V.Afanas'eva.

Optika i Spektrosk., Vol. 5, No. 2, 110-12 (1958). In Russian. English summary: PB 141047T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

An application of Stevens' method (Abstr. 3765 of 1952) to the calculation of the ionic radii of holmium and of erbium. L.Pincherl

539.18 : 535.3

10156. LAMB SHIFTS OF THE GROUND STATES OF He^4 AND H

G.Gertsberg [Herzberg].

Optika i Spektrosk., Vol. 6, No. 4, 429-30 (April, 1959). In Russia

In order to obtain experimentally the Lamb shift of the groun state of helium it is necessary to determine the value of the ionization potential very carefully. For this purpose the wavelengths of far ultraviolet lines of He^4 at 584.3 ($1^1S—2^1P$), 537.0 ($1^1S—3^1P$) and 591.4 A ($1^1S—2^3P_1$) were measured with greater precision tha ever before: they were found to be 584.3339, 537.0293 and 591.41 (all ±0.0005 A). For He^3 the corresponding values, obtained by addition of measured shifts to the wavelengths of He^4 lines, were 584.3640, 537.0577 and 591.4466 A. The terms of the upper states of these lines with respect to the ionization limit were determined anew from measurements of the Bergmann series of lines $3^3D—n^3$ intercombination lines $2^3P—3^1D$ and $2^1P—3^3D$ and near ultraviolet series $2^3P—n^1D$ and $2^3P—n^3D$. Combining these results with the results obtained for far ultraviolet lines, the following ionization potentials were deduced: $198310.8_2 \pm 0.15$ cm^{-1} for He^4 and $198300.3_2 \pm 0.15$ cm^{-1} for He^3. The experimental values of the La shift were obtained by comparison of the empirical ionization potentials with the ionization potentials derived using Dirac's theory without taking quantum electrodynamic effects into account In this way the Lamb shifts were found to be -1.1_8 and -1.2_3cm^{-1} for He^4 and He^3 respectively (the value predicted by Kabir, Salpet and Sucher is $-1.3_3 \pm 0.2$ cm^{-1}). A.Tybulew

539

10157. OSCILLATOR STRENGTHS FOR NEUTRAL HELIUM.

E.Trefftz, A.Schlüter, K.H.Dettmar and K.Jörgens.

Z. Astrophys., Vol. 44, No. 1, 1-17 (1957).. In German.

Oscillator strengths for 30 transitions of He ($^1S \leftrightarrow {}^1P$; $^3S \leftrightarrow {}^3$ $^1P \leftrightarrow {}^1D$; $^3P \leftrightarrow {}^3D$) have been computed theoretically using Hartree Fock wave-functions. R.W.Nicho

539

10158. DIFFUSION, DE-EXCITATION, AND THREE-BODY COLLISION COEFFICIENTS FOR EXCITED NEON ATOMS.

A.V.Phelps.

Phys. Rev., Vol. 114, No. 4, 1011-25 (May 15, 1959).

Diffusion coefficients, de-excitation cross-sections, and thre body collision coefficients for neon atoms of the $1s^22s^22p^53s$ configuration are obtained from optical absorption measurements of

tive decay rates and relative densities of excited atoms following
lsed discharge. Atoms in the lower metastable ($^3P_2$) and the
er radiating ($^3P_1$) states are destroyed by diffusion to the wall,
e-body collisions involving two ground state atoms, and the
pe of imprisoned resonance radiation. The diffusion coefficient
nit neon density and 300° K for the metastable states if 5.5 ×
^{18} cm^{-1} sec^{-1}. The rate of escape of resonance radiation agrees
the predictions of Holstein's theory. At 300° K the average
s-section for collisional de-excitation of $^3P_1$ atoms to the $^3P_2$
e is 5 × 10^{-19} cm^2 and is about 6 × 10^{-20} cm^2 for the $^3P_0$ to $^3P_1$
$^3P_0$ to $^3P_2$ transitions. The cross-section for the $^3P_1$ to $^3P_2$ de-
tation increases by an order of magnitude between 200° K and
K and is three times larger for de-excitation by helium than by
at 300° K. The three-body collision coefficient for the $^3P_2$ state
× 10^{-34} cm^6/sec at 300° K and 5 × 10^{-35} cm^6/sec at 77° K.
mates of average cross-sections for de-excitation by thermal
trons give 10^{-13} cm^2 for the $^3P_1$ to $^3P_2$ process and 10^{-14} cm^2 for
P_0 to $^3P_1$ transition.

539.18 : 535.343 : 535.337

59. MICROWAVE ZEEMAN SPECTRUM OF ATOMIC OXYGEN.

.Radford and V.W.Hughes.
s. Rev., Vol. 114, No. 5, 1274-9 (June 1, 1959).

The technique of paramagnetic resonance absorption was used
easure the g-factors of the ground ^3P term in O^{16} in terms of the
on g-factor. The results are: $-g_J(O;{}^3P_1)/g_p = 493.4236 \pm 0.0002$
$-g_J(O;{}^3P_2)/g_p = 493.4022 \pm 0.0002$, where g_p refers to protons in
lindrical sample of mineral oil. When combined with $g_J(H;{}^2S_{1/2})/g_p$,
sured in analogous experiments on hydrogen, and after inserting
theoretical value of $g_J(H;{}^2S_{1/2})$, the oxygen g-factors are found to
$_J(O;{}^3P_1) = 1.500\,986 \pm 0.000\,002$, $g_J(O;{}^3P_2) = 1.500\,921 \pm 0.000\,002$.
screpancy of 7 parts in 10^6 between these values and correspond-
theoretical g-factors can probably be ascribed to inaccuracy of
atomic wave-functions used in the theoretical calculations.

539.18

60. VARIATIONAL CALCULATIONS OF THE 1s–2s
CTRON EXCITATION CROSS SECTION OF HYDROGEN.

ynn.
c. Phys. Soc., Vol. 73, Pt 3, 515-17 (March, 1959).

In view of a paper by Huck (Abstr. 5868 of 1957), the discrep-
between the results of the direct numerical solution in Abstr.
(1956) and of the variational method of Abstr. 5664 (1953)
ned too large. The latter calculations were repeated, and the
lts exactly confirmed; a further calculation with one more para-
er considerably improved the agreement, showing that no real
naly exists.

J.Hawgood

539.18

61. CALCULATION OF THE LOWEST ^3P, ^1D AND ^1S TERMS
C, N$^+$, O^{++}, F^{3+} AND Ne^{4+} BY MEANS OF THE VARIATIONAL
THOD. N.Salié.

. Phys. (Leipzig), Folge 7, Vol. 3, No. 1-2, 48-54 (1959).
erman.

Energy values and eigenfunctions are calculated for the lowest
es of some 6-electron atoms and ions. Energy levels and
zation potentials are given in tables and graphs and compared
experimental values.

G.F.Lothian

539.18 : 669.053

62. THEORY OF SEPARATION OF ISOTOPES AND ALLOY
MPONENTS DURING PASSAGE OF [ELECTRIC] CURRENT
OUGH THE MELT. S.E.Bresler and G.E Pikus.

tekh. Fiz., Vol. 28, No. 10, 2282-8 (1958). In Russian.

A phenomenological theory of separation of isotopes in a melt
ugh which an electric current is passing was formulated by
authors in an earlier work (Abstr. 8260 of 1956). It was postu-
d that different mobilities of ions are the cause of the separation,
it was shown that the separation process can be described by
n-linear differential equation

$$\frac{\partial c}{\partial x}\left[c(1-c)\gamma\frac{eE}{kT}-\frac{\partial c}{\partial x}\right]=\frac{1}{D}\,\frac{\partial c}{\partial t},$$

re c = concentration of one of the isotopes, D = interdiffusion
ficient, $\gamma = Z\frac{\Delta\mu}{\mu}$, $\Delta\mu = \mu_1 - \mu_2$ — difference of the ion mobilities,
= ion charge, and E = electrical field potential. It is shown in
present paper that the above equation is valid also if other
hanisms of separation are postulated, the parameter γ assuming
fferent physical meaning in each particular case.

M.H.Sloboda

539.18 : 537.534

AN ELECTROMAGNETIC ISOTOPE SEPARATOR.

See Abstr. 9715

539.18

10163. VELOCITIES OF SPUTTERED ATOMS. G.K.Wehner.

Phys. Rev., Vol. 114, No. 5, 1270-2 (June 1, 1959).

The average velocity of atoms sputtered from metal surfaces by normally incident Hg$^+$ ions in a low pressure discharge was found to be unexpectedly high, corresponding to kinetic energies of the order of 10to 30 eV. By sputtering atoms from a (110) surface of a f.c.c. crystal, rather dense atomic beams ejected normal to the target surface can be obtained. The fact that the kinetic energies of the atoms are more than 100 times higher than thermal evaporation energies makes such a beam interesting.

539.18 : 537.534 : 538.1 : 621.318.2

PERMANENT MAGNET FOR ATOMIC BEAM FOCUSING.

See Abstr. 9750

539.18

10164. SLOW-ELECTRON SCATTERING BY ATOMIC OXYGEN.

S.C.Lin and B.Kivel.
Phys. Rev., Vol. 114, No. 4, 1026-7 (May 15, 1959).

The collision cross-section of slow electrons in atomic oxygen has been deduced from simultaneous measurements of the d.c. conductivity and the microwave absorption coefficient of a predominantly atomic oxygen gas mixture in a shock tube. The results showed that the Maxwell-averaged cross-section attributable to atomic oxygen must be about 1.5 × 10^{-16} cm^2 at an electron temperature of 4000° K (mean thermal energy ~0.5 eV). Elaborating on the theoretical method of Klein and Brueckner, it is found that this value is not inconsistent with the photodetachment cross-section of negative oxygen ions measured by Branscomb and co-workers.

539.18

10165. RELATIONSHIP BETWEEN IONIZATION POTENTIALS AND ATOMIC RADII. W.W.Hunt, Jr, and R.E.Huffman.

J. chem. Phys., Vol. 31, No. 1, 266-7 (July, 1959).

The calculated radii of the assumed spherical collision complex formed during ionization of He, Ne, A, Kr, and Xe are in good agreement with the experimental results of Morrison [Reviews of Pure and Applied Chemistry, Vol. 5, 22-59 (1959)]. The ionization potential of the atom is assumed to be the sum of the minimum energy that the captured incident and orbital electrons in the outer orbital of the collision complex require to escape from the complex.

G.I.W.Llewelyn

539.18 : 541.183

10166. THE VARIABILITY OF THE RECOMBINATION OF HYDROGEN ATOMS ON METAL SURFACES.

J.W.Fox, A.C.H.Smith and E.J.Smith.
Proc. Phys. Soc., Vol. 73, Pt 3, 533-5 (March, 1959).

The probability of recombination is not constant for a given metal, but is dependent on certain surface poisoning effects, thus causing errors in calorimetric methods of determining atomic concentrations in atom—molecule mixtures. The effect of temperature on the poisoning and reactivation process has been studied for platinum, tungsten and palladium surfaces.

J.Hawgood

MOLECULES

539.19

10167. THOMAS—FERMI MODEL FOR DIATOMIC HYDRIDES.

T.Tietz.
J. chem. Phys., Vol. 30, No. 4, 1104-5 (April, 1959).

The number of free electrons N, the force constants k_e and the molar diamagnetic susceptibilities χ of forty odd diamagnetic hydrides were calculated numerically on the basis of the Thomas—Fermi method and using the accurate Kobayashi—Taima table [Memoirs of the Faculty of Liberal Arts and Education, Kagawa University, Pt II, No. 33 (1957)] for the Thomas—Fermi function φ_0 and φ_0'. The results are tabulated; a diagram shows χ of the united atom as a function of the nuclear charge Z_u(= Z + 1).

F.Lachman

539.19 : 538.07

10168. A TORSION MAGNETOMETER FOR DETERMINING FREE RADICALS IN SOME ORGANIC SOLUTIONS.
H.Takaki, N.Kawai, C.Miyake and T.Morita.
J. Phys. Soc. Japan, Vol. 13, No. 6, 629-32 (June, 1958).

A torsion pendulum magnetometer whose sensitivity is 1×10^{-10} c.g.s-e.m.u./division was made with fused silica. By using this, a process in which the free radicals appear and disappear was traced magnetically from time to time during the reduction of duroquinone with glucose, and a result showing a fair agreement with Michaelis was obtained. Similar reactions were examined by changing the reducing agents, their concentrations and the temperature. The mean lifetime of free radicals was found to be an exponentially decreasing function with temperature, and to be about 20 min at room temperature.

539.19 : 541.127

H AND C_2H FREE RADICALS IN THE CARBON–HYDROGEN–ACETYLENE EQUILIBRIUM AT HIGH TEMPERATURES. See Abstr. 8954

539.19

10169. THE BEHAVIOUR IN AN ELECTROSTATIC FIELD OF MOLECULES WITH HYDROGEN BONDS WHOSE ENERGY SURFACES HAVE TWO EQUIVALENT MINIMA. S.Bratoz.
J. Chim. phys., Vol. 56, No. 3, 260-5 (March, 1959). In French.

Theoretical. More detailed treatment of discussion in Abstr. 3991 (1959). J.Hawgood

539.19

10170. A SELF-CONSISTENT FIELD FOR THE H_2 MOLECULE.
G.Berthier.
Molecular Phys., Vol. 2, No. 2, 225-6 (April, 1959).

Results obtained by solution of the Hartree–Fock equations for the H_2 molecule assuming the approximation that the wavefunction contains an angular part are discussed. G.I.W.Llewelyn

539.19

10171. QUANTITATIVE THEORY OF DIATOMIC MOLECULES: A SELF-CONSISTENT FIELD FOR THE HYDROGEN MOLECULE.
G.Berthier and M.Mayot.
J. Chim. phys., Vol. 56, No. 5, 504-12 (May, 1959). In French.

See preceding abstract. Further applications of the Hartree–Fock equation are mathematically discussed. G.I.W.Llewelyn

539.19

10172. ON THE CONNECTION BETWEEN THE LARNAUDIE METHOD AND THE EL'YASHEVICH-STEPANOV METHOD OF ZERO APPROXIMATIONS. I.V.Orlova and I.N.Godnev.
Optika i Spektrosk., Vol. 6, No. 4, 447-9 (April, 1959). In Russian.

Larnaudie (Abstr. 9454 of 1954) has recently described an approximate method of calculation of frequencies and force constants of molecules: this is called the "progressive rigidity" method. Transformation of the Larnaudie equations into time equations of El'yashevich shows that the Larnaudie method is one of the variants of the zero approximation of El'yashevich and Stepanov (1949). The Larnaudie method was used to find the force constants of CF_4; the results agree well with Stepanov's exact values.
A.Tybulewicz

539.19

10173. DETERMINATION OF THE ASYMMETRY CONSTANT OF SLIGHTLY ASYMMETRICAL TOP MOLECULES.
S.P.S.Porto and N.Jannuzzi.
An. Acad. Brasil. Cienc., Vol. 31, No. 1, 31-6 (1959).

The infrared spectrum of a slightly asymmetrical top molecule resembles that of a symmetrical top one, at least away from the origin of the band. For small rotational quantum numbers, however, the effect of the asymmetry increases and the shape of the unresolved Q branch near the origin of the band is a function of the assymmetry parameter k. The manner in which the shape of a type C band varies with assumed asymmetry constants, provides a way of determining k and thus a necessary third relation between the rotational constants A, B and C of the molecule, without the need for microwave determinations.

539.19

10174. ERRATA AND SOME ADDITIONAL COMMENTS ON CRITICAL STUDY OF VIBRONIC INTERACTION CALCULATIONS.
A.D.Liehr.
Canad. J. Phys., Vol. 36, No. 11, 1588-9 (Nov., 1958).

The numerical results for the intensities of some benzene vibronic transitions of Abstr. 5445 (1958) are corrected: the qualitative conclusions are not affected. J.Hawgood

539 1

10175. ON THE CALCULATIONAL PROCEDURES IN THE DERIVATION OF THE VIBRATIONAL TRANSITION PROBABILITIE OF THE FIRST NEGATIVE ($b^4\Sigma^-_g \rightarrow a^4\Pi_u$) BANDS OF O_2^+.
N.R.Tawde and N.Sreedhara Murthy.
Indian J. Phys., Vol. 32, No. 3, 128-32 (March, 1958).

Rao and Ranade [Indian J. Phys., Vol. 31, 491 (1957)] have calculated the vibrational transition probabilities of the bands of the O_2^+ (first negative) system. A study of that paper has revealed two very serious errors in the calculations and in the usage of the methods applied by the authors. The first error is due to the wrong usage of the mathematical technique of Manneback (Abstr. 2017 of 1952) for the calculation of vibrational transitional probabilities, an the other error is in the interpretation and derivation of transition probabilities by the application of the method of Manneback and Rahman (Abstr. 10944 of 1954).

539.1

10176. VIBRATIONAL RELAXATION OF NITRIC OXIDE.
F.Robben.
J. chem. Phys., Vol. 31, No. 2, 420-6 (Aug., 1959).

The vibrational relaxation of nitric oxide has been determined in a shock tube with a spectrophotometric technique. The temperature range covered was from 450 to 1300°K, and relaxation times of the order of 5-10 μsec were observed at densities of about 0.07 atm. From the relaxation times P_{1-0}, the probability of de-excitation from the first vibrational level was found to be about 8×10^{-4} at 500°K. Computations of P_{1-0} made according to the theory of Schwartz, Slawsky, and Herzfeld with an interaction potential derived from viscosity measurements are the order of $2 \times 10^{-}$ times smaller than the experimental values. The use of a potential derived from an (NO_2) complex appears to account for the discrepancy.

539.1

10177. VIBRATIONAL CONSTANTS AND DISSOCIATION ENERGY OF THE BeF MOLECULE.
V.M.Tatevskii, L.N.Tunitskii and M.M.Novikov.
Optika i Spektrosk., Vol. 5, No. 5, 520-9 (1958). In Russian.

Reports a new investigation of the vibrational structure of the $A^2\Pi - X^2\Sigma$ bands of BeF. The BeF spectrum was excited using gas-discharge tubes. Since the gas temperature is comparatively low i such tubes the rotational structure of the bands was weaker than in an arc and this reduced overlapping of bands and made it easier to observe new band edges. Forty-eight new edges of Q_1-branches an fifty-four new edges of R_2- and R_1-branches were recorded. Using the results obtained and data published earlier a set of recommend reliable values of the spectroscopic constants of the BeF molecule is derived and dissociation energies of the $X^2\Sigma$ and $A^2\Pi$ states are given as 8 ± 0.5 and 3.9 ± 0.5 eV, respectively. A.Tybulewic

539.1

10178. THE TRANSITION V $^1\Sigma^+$–X $^1\Sigma^+$ IN HYDROGEN CHLORID
J.K.Jacques and R.F.Barrow.
Proc. Phys. Soc., Vol. 23, Pt 3, 538-9 (March, 1959).

A many-line emission spectrum in the region 1800 to 2375 A i assigned to a transition between an ionic state V ($\sigma\pi^4\sigma^*$) $^1\Sigma^+$ and high vibrational levels in the ground state of HCl. Constants deriv for state V from a rotational analysis of 15 bands with $10 \leq v'' \leq 1$ are: $T_0 = 76\,210$, $\omega_e = 880$ cm^{-1}, $r_e = 2.43$ A. A similar spectrum excited in HF vapour proves to arise from the analogous transitio V–X in HF, and not from HF^+, as was first thought (Abstr. 5993, 9740 of 1957). R.F.Barr

539.19 : 535.337 : 535.3

STARK EFFECT IN THE ROTATIONAL SPECTRA OF ASYMMETRICAL-TOP MOLECULES IN THE PRESENCE OF A QUADRUPOLE BOND. See Abstr. 9434

539.

10179. THEORETICAL INVESTIGATION OF THE NEGATIVE HYDROGEN MOLECULE ION. I.Fischer-Hjalmars.
J. chem. Phys., Vol. 30, No. 4, 1099 (April, 1959).

A valence bond treatment of H_2^- with superposition of four co figurations predicts that the molecule ion is much more stable tha predicted by previous calculations, with dissociation energy 2.4 e and the minimum of the potential curve at 0.87 A. The electron affinity of H_2 is calculated as –0.3 eV. J.Hawg

539.19

180. EXPERIMENTAL DETERMINATION OF THE OSCILLATOR RENGTH OF THE FIRST NEGATIVE BANDS OF N_2^+.

G.Bennett and F.W.Dalby.
chem. Phys., Vol. 31, No. 2, 434-41 (Aug., 1959).

The radiative lifetime of the upper state of the 3914 A transi-
n of N_2^+ was measured to be (6.58 ± 0.35) x 10^{-8} sec, correspond-
g to an oscillator strength f of (3.48 ± 0.20) × 10^{-2}. The apparent
diative lifetime of the upper state of the 3371 A transition of the
cond positive system of N_2 was found to depend upon the conditions
excitation. Extrapolation to excitation threshold yields a lifetime
(4.45 ± 0.6) × 10^{-8} sec.

539.19

181. ELECTRONIC STRUCTURE OF LiH ION.

Platas, R.P.Hurst and F.A.Matsen.
chem. Phys., Vol. 31, No. 2, 501-3 (Aug., 1959).

A valence-bond calculation was carried out for $(LiH)^+$ with all
enty structures possible from Slater orbitals 1s, 2s, 2p on
hium and 1s (= 1h) orbital on hydrogen. The total electronic energy
mputed for the ion at the equilibrium distance for the LiH mole-
le is −209.50 eV with only the $1s^21h$ structure making a significant
ntribution to the ground state. When this energy is combined with
corresponding calculated energy for the molecule, a vertical
ization energy of 7.52 eV is obtained. No experimental value has
yet been reported. A technique is developed and is used to obtain
optimum orbital exponents for $1s^21h$ over a wide range of inter-
clear distance. This calculated energy v. distance curve has no
nimum suggesting that $(LiH)^+$ is unstable with respect to dissocia-
n. At R = 3.08 a.u. the wave-function is "degenerate", that is, two
ferent extremum sets of exponents yield the same energy. The
incipal difference is that the orbital exponent of the 1h function is
9 in one set and 1.04 in the other. At R > 3.08 a.u. the second set
res the lowest energy while the reverse is true for R < 3.08 a.u.
is is interpreted as representing the promotion 1s → 2s as is
quired in approaching the united atom.

539.19

182. STUDY OF THE METHANE MOLECULE BY THE SELF-NSISTENT FIELD METHOD. S.Besnainou and M.Roux.

Chim. phys., Vol. 56, No. 3, 250-6 (March, 1959). In French.

The Roothaan method was used for this study, with particular
ention paid to the effects of different approximations and of neg-
cting and varying the multi-centre integrals. It is found that the
al energy is well predicted, but the ionization energies and the
-H bond dipole moment are not satisfactory. J.Hawgood

539.19 : 551.594.51

DE-EXCITATION OF THE NITROGEN MOLECULE META-
ABLE STATE $N_2(A)$. See Abstr. 9102

539.19

183. N.M.R. STUDIES OF HYDROGEN BONDING IN ALCOHOLS ND PHENOL. E.D.Becker.

chem. Phys., Vol. 31, No. 1, 269-70 (July, 1959).

Saunders and Hyne's (Abstr. 6199 of 1959) interpretation of
eir proton magnetic resonance data on methanol, t-butanol and
enol in carbon tetrachloride solution in terms of equilibria
tween monomeric alcohols or phenol and only one H-bonded
ecies (trimer or tetramer) is shown to be at variance with i.r.
ta showing the existence of more than one such species, and to be
nsistent with the presence of dimers as well as higher polymers,
hough the latter may well be the predominant species.
R.C.Murray

539.19 : 537.27

NUCLEAR HYPERFINE STRUCTURE OF A HYDRAZINIC FREE
DICAL. See Abstr. 9820

539.19 : 538.27

FINE STRUCTURE OF THE Cl_2 QUADRUPOLE RESONANCE
ECTRUM. See Abstr. 9849

539.19 : 535.333

184. DIRECTION OF HALOGEN SPECTROSCOPIC MOMENTS.

Goodman and L.J.Frolen.
chem. Phys., Vol. 30, No. 5, 1361-2 (May, 1959).

Examination of the spectra of substituted anisoles shows that
signs of the spectroscopic moments of bromine and iodine are
versed i.e. negative (parallel to the anisole group). This reversal
sign is considered to be evidence for open-shell orbital partici-
tion. In bromo and iodoanisoles the open-shell conjugation effect on the charge distribution overcomes the closed shell effect; in p-chloranisole the two effects approximately balance.
R.C.Seymour

539.19

10185. USE OF ONE-ELECTRON AO-PRODUCT FUNCTIONS IN CALCULATIONS ON THE HYDROGEN MOLECULE.

F.O.Ellison and A.L.Companion.
J. chem. Phys., Vol. 31, No. 1, 285-6 (July, 1959).

Shows that many of the more successful wave functions for H_2 and H_2^+ may be written in terms of products of AO's on both centres, suggesting that the use of products of AO's may be as useful as the traditional LCAO method. Also reports a new open-shell type calculation on H_2 using such AO products. J.Hawgood

539.19

10186. NOVEL PERTURBATION THEORY IN SIMPLE LCAO TREATMENT OF CONJUGATED MOLECULES — METHOD OF PERTURBED SECULAR DETERMINANT.

K.Fukui, C.Nagata, T.Yonezawa, H.Kato and K.Morokuma.
J. chem. Phys., Vol. 31, No. 2, 287-93 (Aug., 1959).

A new method of perturbation theory is developed in the simple LCAO MO treatment of conjugated molecules. Several useful equations are derived, giving orbital energy, electron density, and bond order of the perturbed system.

539.19

10187. A NECESSARY CONDITION FOR THE FORMATION OF AN INTERMOLECULAR HYDROGEN BOND SHOWN BY SPECTROGRAPHIC RESULTS. M.M.Gerbier and J.Gerbier.

C.R. Acad. Sci. (Paris), Vol. 248, No. 5, 669-71 (Feb. 2, 1959).
In French.

The possibility of intermolecular hydrogen bond formation in organic mixtures is directly linked with the vibration frequencies of the groups forming the bond. Measurements made on OH, C=O, and other groups indicate that stable bonding occurs only when a resonance exists between the constituent oscillators.
D.L.Greenaway

539.19

10188. CHEMICAL BOND. III. A ONE-DIMENSIONAL THEORY OF THE ENERGETICS AND IONIC CHARACTER OF THE HYDROGEN BOND. P.C.McKinney and G.M.Barrow.

J. chem. Phys., Vol. 31, No. 2, 294-9 (Aug., 1959).

For Pt II, see Abstr. 2622 (1958). The bond properties of a first-row element bonded to a hydrogen atom are calculated from one-dimensional counterparts of the atomic orbitals. The potential energy function and the ionic character are found to be correctly predicted. The hydrogen bond system O—H···O is described by means of the same atomic wave-functions. The potential energy of the system is obtained for various positions of the hydrogen atom. Predicted properties are in good agreement with experiment. The existence of a second potential minimum is indicated. The contributions of the resonating structures of the system are obtained and are shown to lead to the observed value of dμ/dr for the hydrogen-bonded OH system.

539.19 : 535.343

10189. HYDROGEN BOND: AN EXPERIMENTAL VERIFICATION OF THE DOUBLE MINIMUM POTENTIAL.

C.L.Bell and G.M.Barrow.
J. chem. Phys., Vol. 31, No. 2, 300-7 (Aug., 1959).

The spectra of alcohols in the region of the first and second OH stretching overtone in solvents of various bonding strengths reveal a pair of solvent-dependent absorption bands. These bands are shown to arise from an energy level splitting resulting from a double minimum in the potential energy curve for the proton. The form that the potential energy curve must assume to yield the observed spectra is such that the second minimum lies in the region of the v = 2 vibrational energy level for ordinary hydrogen bonding situations. The higher overtone bands, particularly in strongly basic solvents, are characteristic of the broad potential well. This observed splitting of the absorption bands of hydrogen-bonded alcohols confirms the theoretical predictions of a double minimum potential energy function for the proton (see preceding abstract).

539.19

10190. THEORY OF HYDROGEN BONDING. L.Hofacker.

Z. Naturforsch., Vol. 13a, No. 12, 1044-57 (Dec., 1958).
In German.

A theory of hydrogen bonding is developed from molecular orbital method. The formation of hydrogen bonds between H_2O and aliphatic alcohols is treated numerically by the theory and the various contributions to the bond energy calculated.

R.C.Seymour

539.19

10191. QUANTUM THEORETICAL STUDY ON SINGLE, DOUBLE AND TRIPLE BONDS BETWEEN CARBON ATOMS. S.Nagahara.

J. Phys. Soc. Japan, Vol. 14, No. 3, 331-47 (March, 1959).

Studied by idealizing the problem to the electronic structure of fictitious diatomic molecules $\equiv C-C \equiv$, $=C=C=$ and $-C \equiv C-$, where the "open" bonds of carbon atoms are represented by a suitably hybridized orbitals, associated with free spins. Thus, adiabatic potentials are non-empirically and numerically computed and bond energies and equilibrium internuclear distances are evaluated. One obtains 3.1, 1.25 eV and 0.20, 0.10 A for the values of relative bond energy differences and bond distance differences of single and triple, double and triple bonding. The corresponding experimental values are 2.9, 1.0 eV and 0.34, 0.12 A, respectively.

539.19

10192. SEMIQUANTITATIVE UNITED-ATOM TREATMENT AND THE SHAPE OF TRIATOMIC MOLECULES. C.E.Wulfman.

J. chem. Phys., Vol. 31, No. 2, 381-6 (Aug., 1959).

The united-atom expansion of the potential energy of an electron in a molecular field is transformed into a Maclaurin series expansion containing a remainder term. It is shown that, if the centre of nuclear charge is chosen to remain at the origin, the first non-zero terms of this expansion are quadratic in the nuclear separations. These terms determine the orbital properties as the nuclei in the united atom are slightly separated, and are useful in establishing correlation diagrams. Several such diagrams are given for triatomic molecules. The angular derivatives of the quadratic terms are used in an investigation of the angular stability of linear molecules composed of atoms from the second row of the periodic table. It is found that these derivatives themselves correctly indicate the linearity or nonlinearity of all except 26-electron systems, and that the nonlinearity of 26-electron systems is accounted for if internuclear repulsions are taken into account. Extensions and limitations of this result, and its implications with respect to theories of molecular shape,are briefly discussed.

539.19

10193. LIGAND INFLUENCE UPON RADIAL WAVE FUNCTIONS. R.L.Belford and M.Karplus.

J. chem. Phys., Vol. 31, No. 2, 394-9 (Aug., 1959).

The influence of the ligand field upon the radial distribution function for the 3d orbitals of a transition metal complex ion has been investigated. A simple one-electron approximation was used for the metal ion and a point charge model was employed for the ligands. Exact numerical solutions of the resulting radial equations were obtained and compared with one-parameter variation functions. For reasonable ligand charges and distances, the displacements in orbital energies and transition frequencies are found to be smaller than the errors in current theories. However, the differential expansions and contractions in the orbitals are sufficiently large to produce significant changes in certain radial integrals.

539.19

10194. SEQUENCE AND SPACING OF n → π TRANSITIONS IN S-TRIAZINE. J.S.Brinen and L.Goodman.

J. chem. Phys., Vol. 31, No. 2, 482-7 (Aug., 1959).

Calculations are made by the MO method, including zeroth-order configuration interaction of the lowest singlet and triplet (n,π^*) state energies in s-triazine in three approximations: (1) including only one- and two-centre integrals evaluated theoretically; (2) including three-centre integrals evaluated semiempirically; (3) different overlap approximation, integrals evaluated empirically. Under all three approximations, the four lowest singlet—singlet excitations comprising one allowed and three forbidden transitions are predicted to be grouped within 1 eV and the lowest energy excitation is predicted to be forbidden. The assignment of the lowest energy transition is dependent upon 3-centre integral values and is tentatively ${}^1E'' \rightarrow {}^1A'_1$. The lowest $n \rightarrow \pi^*$ singlet—triplet excitation is predicted to be orbitally forbidden $({}^3E'' \leftarrow {}^1A_1')$ with a split of ~ 0.6 eV from the corresponding singlet, and approximately degenerate with the lowest energy $(\pi \rightarrow \pi^*)$ multiplicity-forbidden transition $({}^3A_1' \leftarrow {}^1A_1')$. The dependence of the energy levels upon the n-orbital hybridization is investigated.

539.19 : 538.2

MAGNETIC PROPERTIES OF THE H_2O MOLECULE, FROM LCAO MO CALCULATIONS. See Abstr. 9757

539.19

10195. DETERMINATION OF INTERNUCLEAR DISTANCE IN DI-ATOMIC MOLECULES FROM THE INTENSITY OF VIBRATIONAL BANDS. S.P.Sinha and S.S.Prasad.

Curr. Sci., Vol. 28, No. 2, 61-2 (Feb., 1959).

This reverses the usual procedure, whereby the difference between the equilibrium internuclear distances for the initial and final states is a parameter in calculating the band intensity. If the internuclear distance is known for one state, that for the other can be found without rotational analysis. Results agree well with other methods.

J.Hawgood

539.19

10196. MICROWAVE SPECTRUM AND STRUCTURE OF PROPYNAL (H—C≡C—CHO). C.C.Costain and J.R.Morton.

J. chem. Phys., Vol. 31, No. 2, 389-93 (Aug., 1959).

The moments of inertia I_B^0 and I_C^0 of fifteen isotopic species of propynal have been determined from the frequencies of certain lines in the type a spectra. With the aid of type b transitions, I_A^0 and the inertial defects Δ have been obtained for some of the isotopic species. Using equations relating the atomic coordinates to the change in the moments of inertia on isotopic substitution, three independent sets of molecular parameters have been obtained (two for $C{=}O$). The agreement between the three sets of data is within the probable experimental error. The mean values of the molecular parameters are as follows: $r_s(C-H)$ (acet.) = 1.055_3A, $r_s(C-H)$(ald. = 1.106_4 A, $r_s(C \equiv C) = 1.208_9$ A, $r_s(C-C) = 1.444_8$ A, $r_s(C{=}O)$ = 1.215_0 A, ∡CCO = $123^{\circ}47'$, ∡CCC = $178^{\circ}24'$, ∡CCH (ald.) = $113^{\circ}54'$ ∡CCH (acet.) = $180^{\circ}0'$. The error in the bond lengths is estimated to be ±0.001 A, and in the angles ±10'. A slight deviation from linearity ($1^{\circ}36' \pm 10'$) was apparent in the carbon chain.

539.19

10197. MOLECULAR STRUCTURE OF ETHYLENE.

L.S.Bartell and R.A.Bonham.

J. chem. Phys., Vol. 31, No. 2, 400-4 (Aug., 1959).

The structure of gaseous ethylene was investigated by the sector-microphotometer method of electron diffraction. The major internuclear distances, in terms of centre of gravity parameters $r_g(0)$, were found to be $C-H = 1.084 \pm 0.003$ A, $C{=}C = 1.332_7 \pm 0.00$ A, and $C{-}{-}H = 2.120 \pm 0.006$ A, and the angle H—C—H was $115.5^{\circ} \pm 0.$ Root-mean-square amplitudes of vibration were $l_{C-H} = 0.076_8$ ± 0.003 A, $l_{C=C} = 0.043_9 \pm 0.002$ A, and $l_{C-H} = 0.102 \pm 0.006$ A, which values agree reasonably well with values calculated from spectroscopic data. The uncertainties reported represent standard errors computed by a simplified method from least squares analyse of parameters. Discrepancies between the diffraction results and those of new infrared and Raman results are discussed in terms of the arbitrariness arising from the different operational definitions of bond distances and angles involved.

539.19

10198. DIELECTRIC PROPERTIES OF POLYPEPTIDE SOLUTIONS. IV. SEVERAL PROBLEMS ON THE ELECTRIC DIPOLE MOMENT OF THE α-HELIX. A.Wada.

J. chem. Phys., Vol. 31, No. 2, 495-500 (Aug., 1959).

Relating to the dielectric properties of the α-helical molecule described in a previous report (see Abstr. 6878-9 of 1959), the following problems were studied from the standpoint of the confirme structure of this molecule. 1. The electric dipole moment of the α-helix was estimated considering the dipole moment in the side chain besides that in the backbone chain. 2. The dielectric constant of the solution of α-helices was obtained in terms of the dipole moment and polarizability of the solute molecules. The reaction field, which will be induced in such a cylindrical molecule immersed in the dielectric media, was also examined. 3. It was found that the deviation of the observed dielectric dispersion and absorption curve from Debye's theoretical one of single relaxation time could satisfactorily be explained when the polydispersity of the molecular weig was taken into account.

539.1

10199. DIPOLE MOMENT FUNCTION OF $CO({}^1\Sigma^+)$.

H.Salwen and J.Trischka.

J. chem. Phys., Vol. 31, No. 2, 541-3 (Aug., 1959).

The possible dipole moment functions of $CO({}^1\Sigma^+)$ are calculate by means of the wave-function approximation with wave-functions for a Morse potential. The dipole moment functions are expressed polynomials whose coefficients through the quartic terms are en in a table. The accuracy of the dipole moment functions is dis- sed for the case in which only the first two vibrational matrix ments are known. This discussion is based on calculations made both the wave-function approximation and an older method, the ynomial approximation. A Morse potential and a polynomial ential are compared to determine their relative suitability for the culation of the dipole moment function of $CO(^1\Sigma^+)$.

539.19

00. DETERMINATION OF THE ELECTRICAL DIPOLE MENTS OF TlF WITH A MOLECULAR-BEAM RESONANCE PARATUS. G.Gräff.

Phys., Vol. 155, No. 4, 433-40 (1959). In German.

By improving the resolving power of a molecular beam resonance aratus, it became possible to measure two new effects: (a) the tope effect of the electric dipole moment μ; (b) the dependence of) on v^2. For this purpose, μ^2/B was measured in $\Delta m_1 = \pm 1$ tran- ions in the J = 1 rotational state and in vibrational states v = 0, 1, 2. From this quantity these effects were calculated. These ults are compared with Schlier's calculations (Abstr. 6206 of 9). Furthermore, the sum of the magnetic spin—rotational eraction constants $c_{Tl} + c_F$ was measured for v = 1 and 2. A thod is described for measuring the spontaneous transition bability for the v = 1 → v = 0 transitions.

539.19

201. DETERMINATION OF THE STRUCTURE AND THE DIPOLE MENT OF THE HDSe MOLECULE FROM ITS MICROWAVE ECTRUM. V.G.Veselago.

tika i Spektrosk., Vol. 6, No. 4, 450-6 (April, 1959). In Russian.

To determine the structure of hydrogen selenide, with the trifugal perturbation taken into account, the author used the ectrum of HDSe in the centimetre region. The rotational constants the HDSe molecule were calculated taking into account the centri- al perturbation (the rigid asymmetrical top approximation gave ccurate results). From the rotational constants and other data structure of the HDSe molecule was determined. This molecule a triangle with bond lengths Se—H and Se—D of 1.452 and 1.446 A spectively; the angle H—Se—D is 90°17' ± 50'. The structures of HDO and HDS molecules were also determined using spectra ob- ned earlier. The HDS structure is given by r(S—H) = 1.3283 A, —D) = 1.3215 A and the angle H—S—D is 92°6'. For HDO the lowing structural constants were deduced: r(O—H) = 0.9458 A, —D) = 0.9405 A and the angle H—O—D is 104°27'. The dipole ment of HDSe (determined from splitting of lines in a constant ctric field) was found to be 0.62 debye. A.Tybulewicz

539.19 : 548.74

202. C—H DISTANCE IN THE CRYSTAL STRUCTURE OF RAFFINS. B.K.Vainshtein and A.N.Lobachev.

kl. Akad. Nauk SSSR, Vol. 120, No. 3, 523-6 (1958). In Russian. glish translation in: Soviet Physics—"Doklady" (New York), l. 3, No. 3, 495-7 (May-June, 1958).

An electron diffraction investigation has been made of the ucture of three paraffins ($C_{18}H_{38}$, $C_{30}H_{62}$ and one with m.p. 53.5°C). o-dimensional Fourier projections followed by difference Fourier ojections were used to estimate the hydrogen coordinates. The lues of the bonds $C-H_1$ and $C-H_2$ were, respectively, for $C_{18}H_{38}$, 140 and 1.127; for $C_{30}H_{62}$, 1.121 and 1.140; for the hydrocarbon th m.p. 53.5, 1.102 and 1.112 A. The estimated r.m.s. error is 14 A. It is concluded that in paraffins the C—H bond is signifi- ntly longer than in aromatic compounds where a distance of 8 A is found. J.Iball

539.19

203. ELECTRON DIFFRACTION STUDY OF THE STRUCTURE F PHOSPHINE. L.S.Bartell and R.C.Hirst.

chem. Phys., Vol. 31, No. 2, 449-51 (Aug., 1959).

The structure of gaseous phosphine was investigated by the ctor-microphotometer method of electron diffraction. It was found at the length of the P—H bond was $r_g(0) = 1.437 \pm 0.004$ A and the ot-mean-square amplitude of vibration was 0.085 ± 0.008 A where e quoted uncertainties represent standard errors. The asymmetry the stretching vibration was estimated and used to deduce the proximate equilibrium bond length, $r_e \sim 1.419$ A. The H—H dis- nce, while observed, was not sufficiently accurate to provide a eful value of the bond angle. The diffraction values are compared th spectroscopic values considering briefly the effect of the zero- int vibrations on each.

539.19

10204. ELECTRON DIFFRACTION INVESTIGATION OF TRIPHENYLAMINE. Y.Sasaki, K.Kimura and M.Kubo.

J. chem. Phys., Vol. 31, No. 2, 477-81 (Aug., 1959).

The molecular structure of triphenylamine in the gaseous state was determined by means of the sector-microphotometer method in electron diffraction. Some useful information on bond lengths and valency angles was obtained by resolving the radial distribution curve, on the basis of which a more detailed interpretation of the molecular intensity was made with the comparison between experimental and theoretical intensity curves. Some features in the intensity curves were found to be sensitive to changes in the angle ∠CNC and the twist angle ϕ of phenyl groups about their respective principal axes from the position in which the threefold axis of symmetry lies on the plane of each phenyl group. The experimental intensity data were adequately interpreted in terms of a nonplanar model having C_3 symmetry. A planar structure was definitely ruled out by the present analysis. Probable values for the molecular parameters adjusted by the method of least squares are: r(C—C) = 1.392 ± 0.006 A, r(C—N) = 1.42 ± 0.04 A, ∠CNC = 116° ± 2°, and ϕ = 47° ± 5°.

539.19

10205. STEPWISE FORMULATION OF THE ACTIVATION RATE IN UNIMOLECULAR REACTIONS. B.H.Mahan.

J. chem. Phys., Vol. 31, No. 1, 270-1 (July, 1959).

The activation rate for translation—vibration excitation is treated as a multibarrier problem; the results are consistent with experiment. J.Hawgood

539.19

10206. ON THE PARTICIPATION OF EXCITED IONS IN ION—MOLECULE REACTIONS. G.G.Meisels.

J. chem. Phys., Vol. 31, No. 1, 284-5 (July, 1959).

Ion—molecule reactions must generally be exothermic to occur at all, but apparently endothermic reactions can occur with excited ions, the energy of excitation making the overall reaction exothermic, e.g. in the radiolysis of gases where considerable numbers of excited ions are produced. $H_2 + C_2H_6$ have been found in the radiolysis of $Xe-CH_4$ mixtures, with ion pair yields of up to 0.9 for H_2 (even though > 95% of the primary ionization is in Xe), decreasing with increase of Xe concentration, probably because of de-excitation of the metastable state by collisions with Xe atoms. R.C.Murray

539.19 : 530.162

10207. STUDIES IN MOLECULAR DYNAMICS. I. GENERAL METHOD. B.J.Alder and T.E.Wainwright.

J. chem. Phys., Vol. 31, No. 2, 459-66 (Aug., 1959).

A method is outlined by which it is possible to calculate exactly the behaviour of several hundred interacting classical particles. The study of this many-body problem is carried out by an electronic computer which solves numerically the simultaneous equations of motion. The limitations of this numerical scheme are enumerated and the important steps in making the programme efficient on the computers are indicated. The applicability of this method to the solution of many problems in both equilibrium and nonequilibrium statistical mechanics is discussed.

539.19

10208. SPECTROSCOPIC EVIDENCE FOR LONG-RANGE REPULSIVE INTERMOLECULAR FORCES.

W.W.Robertson and A.D.King, Jr.

J. chem. Phys., Vol. 31, No. 2, 473-6 (Aug., 1959).

Experimental results are presented on the shift wavelength of absorption of benzene, naphthalene, pyrene, and phenanthrene with density of the diluents helium and nitrogen. Arguments are presented to show that the blue shift observed in the benzene ^1L_b spectrum in helium is neither due to short-range repulsive forces nor to long-range dispersive forces. It is presumed that there are weak, long-range, non-dispersive forces present in the benzene—helium interaction that have the character of repulsive forces.

539.19

10209. CONTRIBUTION TO THE STUDY OF INTERMOLECULAR FORCES IN CONNECTION WITH THE EQUATION OF STATE OF GASES AND THE PERTURBATIONS OF SPECTRAL LINES UNDER HIGH PRESSURE. R.Bergeon.

J. Rech. Cent. Nat. Rech. Sci., No. 44, 171-207 (Sept., 1958). In French.

Presents detailed statistical mechanical calculations with analysis of the agreement with experimental data, particularly for high pressures, for the following problems: (1) the square-well interaction of up to four molecules giving the fourth virial coefficient without the usual approximations, the effects of which are examined; (2) third virial coefficient with a Buckingham potential; (3) interaction of two molecules when one is excited, giving the effect of pressure on spectrum. 60 references. J.Hawgood

539.19

10210. THEORETICAL DEPOLYMERIZATION KINETICS IN POLYMERS HAVING AN INITIAL "MOST PROBABLE" MOLECULAR WEIGHT DISTRIBUTION. R.H.Boyd.

J. chem. Phys., Vol. 31, No. 2, 321-8 (Aug., 1959).

The kinetic equations describing a general chain mechanism of depolymerization are solved at steady state for a polymer having an initial "most probable" molecular weight distribution. Chain scission initiation, end group initiation, depropagation, intermolecular chain transfer, and several types of termination are considered. In the past, solutions have been limited to special cases and approximations. Now general expressions for molecular weight change and rate of weight loss are available for polymers with an initial molecular weight distribution of wide interest. The relationships to the previously considered special cases are discussed.

539.19 : 539.21

10211. ON THE EFFECT OF HIGH ENERGY RADIATION ON POLYMERS. I. CROSS-LINKING AND DEGRADATION. O.Saito.

J. Phys. Soc. Japan, Vol. 13, No. 2, 198-206 (Feb., 1958).

Integro-differential equations are obtained, which describe the variation of molecular weight distributions in a polymer substance caused by irradiation. The solutions of these equations give the gel point and the average molecular weights. In the case of cross-linking without cyclization, the results agree with those obtained by other authors. The problems involving cyclization and branching are also solved, showing that the gel formation is retarded by cyclization and that the weight average branching number diverges at the gel point, while the number average branching number does not. As for degradation, the molecular weight distributions for an arbitrary radiation dose are obtained, and it is shown that for any initial distribution the final molecular weight distribution becomes Poisson-like. The problem which deals with the case where cross-linking and degradation coexist is also discussed, and it is shown that for any initial distribution the gel formation occurs only when the ratio of the two probabilities concerning degradation and cross-linking is smaller than 4.

539.19 : 539.21

10212. EFFECTS OF HIGH ENERGY RADIATION ON POLYMERS. II. END-LINKING AND GEL FRACTION. O.Saito.

J. Phys. Soc. Japan, Vol. 13, No. 12, 1451-64 (Dec., 1958).

The effect of end-linking induced in polymers by high energy radiation is discussed. When cyclization does not occur, the same results are obtained as those derived by Charlesby, and moreover it is known that for any initial distribution the gel formation does not occur when σ is smaller than $\frac{1}{4}$, where σ represents the probability that an end produced by a molecular scission links with a monomer unit of another molecule. The theory also gives the average molecular weights and the average end numbers. For the initial uniform distribution the weight average molecular weight has a maximum in case $\frac{1}{12} < \sigma < \frac{1}{4}$, while for the initial Poisson distribution it has no maximum. The weight average end number becomes infinite at the gel point, but the number average end number does not. It is shown that the retardation of incipient gel formation is negligible when cyclization occurs. Beyond the gel point the gel part grows rapidly. The feature is studied in the cases of cross-linking and end-linking with or without cyclization, and it is shown that the gel fraction is smaller by several per cent in the case with cyclization than in the case without cyclization.

539.19 : 539.21

10213. EFFECTS OF HIGH ENERGY RADIATION ON POLYMERS. III. VISCOSITY. O.Saito.

J. Phys. Soc. Japan, Vol. 13, No. 12, 1465-76 (Dec., 1958).

It was known that solubility of irradiated polymers was not free from the effect of cyclization. On the contrary, viscosity before gel point is not affected by it and it is utilized in order to investigate the effects of high energy radiation on polymers. Intrinsic viscosity is discussed first for the case where cross-linking and degradation occur. In certain cases intrinsic viscosity decreases in the initial period of irradiation, but increases in larger radiation doses, so that it has a minimum and becomes infinite at a certain radiation dose which corresponds to gel point. The G-values of cross-linking and degradation are calculated from the intrinsic viscosity in the initial period of irradiation. An example of polyvinylchloride give G-values whose orders of magnitude are not unreasonable. Intrins viscosity for the case where end-linking occurs is likewise discus and the same properties as those in cross-linking are derived. Finally it is known that the gel point determined from an asymptot behaviour of intrinsic viscosity will be more correct than that dete mined from an extrapolation of solubility curve.

539.

10214. ELEMENTARY PROBLEMS ON THE CONFIGURATIONS OF A LINEAR HIGH POLYMER. K.Nagai.

J. Phys. Soc. Japan, Vol. 13, No. 8, 928-34 (Aug., 1958).

An operational method is used. General expressions for the distributions of the end-to-end distance, of the distance between th i-th segment and the centre of gravity and of the segment density around the centre of gravity are obtained. This method can be applied to the general random flight problems by using the Laplace transformation of the discontinuous integral.

539.

10215. EXPECTED SQUARE OF THE LENGTH OF A HYDROCARBON-TYPE CHAIN. A.V.Tobolsky.

J. chem. Phys., Vol. 31, No. 2, 387-89 (Aug., 1959).

Three successive bonds along a hydrocarbon chain may be in planar trans configuration or in two non-planar gauche configurati The energy of the trans configuration is taken as zero and the ener gies of the two gauche configurations are each taken as ϵ (per mol The mean square length of a hydrocarbon-type chain of n links eac of length l_0 is shown to be

$$\bar{r}^2 = [(2 + 6a)/(3 - 3a)]nl_0^2,$$

where

$$a = 1/[1 + 2\exp(-\epsilon/RT)].$$

The problem of excluded volume is not considered here.

539.

10216. THEORY OF THE PHASE TRANSITION BETWEEN HELIX AND RANDOM COIL IN POLYPEPTIDE CHAINS.

B.H.Zimm and J.K.Bragg.

J. chem. Phys., Vol. 31, No. 2, 526-35 (Aug., 1959).

The transition between the helical and randomly coiled forms of a polypeptide chain is discussed by reference to a simple mode that allows bonding only between each group and the third precedi Two principal parameters are introduced, a statistical parameter that is essentially an equilibrium constant for the bonding of segments to a portion of the chain that is already in helical form, and a special correction factor for the initiation of a helix. A third parameter which specifies the minimum number of segments in a random section between two helical portions has only a minor effe on the results. The partition function for this model is handled in two alternative ways, either as a summation suitable for short chains, or in terms of the eigenvalues and eigenvectors of a chara teristic matrix; the latter is more suitable for long chains. A transition from the random to the helical form is encountered as either the bonding parameter or the chain length is increased. Th critical value of the bonding parameter is unity for long chains, while the sharpness of the transition depends on the initiation para meter. Depending on the values of the bonding parameter and the chain length, one of the following configurations dominates : rand coils, single helices with occasional disorder at the ends, and for longer chains, helices occasionally broken by random sections. I rather narrow transition regions, mixtures of these forms may be found. A diagram is given that displays the relationships of these forms. The theory is compared with published data on polybenzyl glutamate with fair agreement.

539.19 : 57

SYNTHESIS OF BIOLOGICAL MACROMOLECULES. See Abstr. 9108

539.19 : 53

RHEOLOGY OF MACROMOLECULAR SYSTEMS. See Abstr. 9277

539.19 : 53

CONCENTRATED MACROMOLECULAR SOLUTIONS. See Abstr. 9306

539.19 : 5

10217. SEPARATION OF GAS MIXTURES IN A SUPERSONIC J

P.C.Waterman and S.A.Stern.

J. chem. Phys., Vol. 31, No. 2, 405-19 (Aug., 1959).

Becker and co-workers (Abstr. 2217 of 1955) discovered that ge composition gradients existed in the supersonic jet generated xpanding a gas mixture through a Laval nozzle. Further experintal observations of this effect are presented for the mixtures N_2, O_2—N_2, and N_2—C_2H_4, showing characteristics of the phenomn not previously reported. A quantitative theory based on freeecule kinetics is suggested, and gives reasonable agreement with experimental results in several respects.

SOLID-STATE PHYSICS

539.2 : 548.5

18. GROWTH AND DEFECTS OF SEMICONDUCTOR CRYSTALS. illig.
iconductors and phosphors. See Abstr. 9597 pp. 2-16.

A review paper, with reference to recent developments, on iconductor crystal defects, methods of crystal growth, techniques tudying defects, the origin of lattice defects, twinning and dets caused by plastic deformation. The paper is illustrated by photographs and figures. J.B.Birks

539.2

19. THE INCORPORATION OF FOREIGN ATOMS IN YSTALLINE SOLIDS. F.A.Kröger and H.J.Vink.
iconductors and phosphors. See Abstr. 9597 pp. 17-34.

An integrating review of the whole field. It is shown how the centrations of the various natural atomic and electronic impertions and of those due to impurity atoms depend on each other on the composition of the gas phase. Various ways of incorpoion of the impurity atoms are described, and it is shown that the perfection properties of the crystal depend on the manner of orporation. A number of examples are given to illustrate the rious possibilities, and a new nomenclature for describing centres crystals is proposed. There are 80 references. J.B.Birks

539.2

220. GENERATION OF IMPERFECTIONS BY THERMAL RESS. P.Penning.
iconductors and phosphors. See Abstr. 9597 pp. 482-5.

The effects are considered of radial and axial thermal stresses germanium crystals during growth on the formation of dislocations. J.B.Birks

539.2

221. ON THE DISTRIBUTION OF IMPURITY ATOMS IN THE RESS FIELD OF A DISLOCATION. D.M.Beshers.
ta metallurgica, Vol. 6, No. 8, 521-3 (Aug., 1958).

It is shown that impurity atoms distributed in the stress field a dislocation obey Fermi—Dirac statistics. This result is plied to two experimental situations. First, it enables one to termine the binding energy of an impurity to a dislocation, and condly, it shows why another attempt to do this went astray.

539.2

222. ON THE SCREENED FIELD AROUND AN IMPURITY OM IN METAL. H.Fujiwara.
Phys. Soc. Japan, Vol. 13, No. 3, 250-60 (March, 1958).

By using a newly proposed model, in which the positive charges bare nuclei of an impurity atom and the matrix atoms are put at lattice points and all the electrons, valence electrons as well core ones, are treated by Thomas—Fermi method, the deviation the potential from the periodic one for the pure matrix metal due the presence of an impurity atom has been calculated and compred with the screened Coulomb potential obtained in previous pers. In the case of pure metals, a similar treatment was made Slater and Krutter, so that this model may be regarded as an tension of theirs to the case of substitutional impurity. The obined potential is nearly proportional to ΔZ, where $\Delta Z = Z_i - Z$, and Z being atomic numbers of the impurity and the matrix atom spectively and in this paper, the cases of $\Delta Z = \pm 2$ and ± 1 are eated.

539.2

223. DISLOCATION THEORY OF FRACTURE OF CRYSTALS. E.Fujita.
ta metallurgica, Vol. 6, No. 8, 543-51 (Aug., 1958).

A dislocation theory of fracture of crystalline materials is proposed. First, the stability of a thin flat void in a crystal is considered. The estimated critical length of the void is of the order of 10^{-6}-10^{-5} cm provided that the thickness is of a few atomic spacings. From such a small crack one cannot expect a large stress concentration or a high strain energy enough to produce a spreading crack. Piling up of edge dislocations might be a cause of fracture in some cases, but this mechanism is also inconceivable unless a strong obstacle to impede the release of piling up dislocations does exist. However, one can consider a long flat void which is produced on the slip plane during plastic deformation of the crystal, and contains a certain number of edge dislocations. This void has the effect of trapping dislocations by piling up dislocations in the rear of it, but without the help of the obstacle. Stress distribution around the void is calculated, and it is shown that this kind of small void can produce the concentrated tensile stress so large as to make a crack spread from the tip of it. Strain energy method is also applied, and it is found that this small void can grow to be a large crack, even if it is of the order of 10^{-6}-10^{-5} cm in length.

539.2

10224. EXPERIMENTAL OBSERVATION OF DISLOCATION SOURCES USING PRECIPITATES. V.G.Rakin and N.N.Buinov.
Dokl. Akad. Nauk SSSR, Vol. 121, No. 2, 271-3 (1958). In Russian.

Contains experimental observations of Frank—Read dislocation sources, using the technique of observing the distribution of precipitates of the θ'-phase in Al alloys containing 4% Cu. The sources lie in a considerable number of crystallographic planes: an analysis of 43 photographs is given. Figures are quoted for the average distance between dislocation loops (~ 0.5 μ) and for the dislocation densities (~ 10^5 cm^{-2}). Evidence is also given for the existence of a second type of dislocation source which contains two pinned dislocations of opposite sign. M.G.Priestley

539.2

10225. ONE TO ONE CORRESPONDENCE BETWEEN ETCH PITS AND DISLOCATIONS IN KCl CRYSTALS.
M.Sakamoto and S.Kobayashi.
J. Phys. Soc. Japan, Vol. 13, No. 8, 800-9 (Aug., 1958).

Etch pits of KCl crystals obtained with dehydrated glacial acetic acid were observed. KCl is so soft, compared with LiF, that dislocations are generated on it by slight mechanical shocks. Therefore, surfaces of KCl crystal are apt to be contaminated, in the sense of dislocation theory. It is supposed that their depth usually reaches 100 μ or more, and that most of the dislocations are surface half loops and isolated loops. One-to-one correspondence between etch pits and dislocations is discussed.

539.2

10226. DISLOCATIONS IN CRYSTALS. V.L.Indenbom.
Kristallografiya, Vol. 3, No. 1, 113-32 (1958). In Russian.

A review dealing with: dislocations and the theory of elasticity; macroscopic description of dislocations; topography of faces and screw dislocations; detection of dislocations by etching and decoration; macroscopic curvature of the lattice and dislocations; dislocation structure of grain boundaries; stress around dislocations; plastic deformation as a result of movement of dislocations; experimental confirmation of the movement of dislocations; dislocations and other defects of the lattice. 111 references. R.F.S.Hearmon

539.2

10227. MOBILITY OF DISLOCATIONS IN THE FRENKEL—KONTOROVA MODEL. V.L.Indenbom.
Kristallografiya, Vol. 3, No. 2, 197-205 (1958). In Russian.

The Frenkel—Kontorova model is developed mathematically to estimate the shear strength and the stress required to move a dislocation. The values obtained in both cases agree with the known results. R.F.S.Hearmon

539.2

10228. FORMATION OF SCREW DISLOCATIONS THROUGH OVERGROWING OF SOLID PARTICLES BY THE CRYSTAL.
M.I.Kozlovskii.
Kristallografiya, Vol. 3, No. 2, 209-13 (1958). In Russian.

It is shown experimentally that screw dislocations may be formed by the capture of extraneous particles during the growth of β-methyl naphthalene crystals from alcoholic solution or from the melt. The probability of formation of a screw dislocation by this means is calculated. R.F.S.Hearmon

539.2

10229. SURFACE DISTORTION ROUND DISLOCATIONS.
V.G.Bhide.
Physica, Vol. 24, No. 10, 817-20 (Oct., 1958).

An interferometric study is made of the surface distortion surrounding a dislocation nucleus responsible for a spiral growth on silicon carbide. The nucleus is shown to be a small hexagonal pit surrounded by a hexagonal depression. S.Tolansky

539.2 : 536.422

10230. SPIRAL-LAYER EVAPORATION OF CRYSTALS.

E.D.Dukova.

Dokl. Akad. Nauk SSSR, Vol. 121, No. 2, 288-9 (1958). In Russian.

Much recent work has identified the presence of a spiral feature on the surface of a crystal with the presence of a screw dislocation. The object of the work was to investigate the processes of such spirals during evaporation or dissolution. Crystals of para-toluidine and naphthalene used in a previous investigation were suitable. It was found possible to reverse from growth to evaporation with a stationary state in between. The spiral forms were recorded by a cine camera, and these are described at different stages by twelve plates and six diagrams. W.Bardsley

539.2

10231. SCATTERING OF PHONONS BY ELASTIC STRAIN FIELDS AND THE THERMAL RESISTANCE OF DISLOCATIONS.

P.Carruthers.

Phys. Rev., Vol. 114, No. 4, 995-1001 (May 15, 1959).

A theory of the scattering of phonons by static elastic strain fields is presented. It is found that the Fourier component of the strain field plays a role similar to that of the potential in the external field approximation. All quantities (except the strain field) in the formulae obtained refer to specifically atomic characteristics, allowing in principle the examination of the influence of crystal structure, interatomic potentials, etc., and also scattering between different polarization modes. A Boltzmann equation is found. The results of the theory are used to estimate the low temperature thermal resistance (in nonconductors) due to dislocations. This is done by finding a relaxation time τ; with some simplifying assumptions one finds for an edge dislocation $\tau^{-1} = A\sigma[\ln(nb^{-1}\sigma^{-1/2})]^2q$. In this equation σ is the density of dislocations, n is the average number in a slip plane, b is the Burgers vector, q is the wave vector of the phonon, A is a constant. This result differs from that obtained previously by Klemens by essentially the presence of the logarithm. This latter factor seems to be essential in explaining the experimental observations of Sproull et al. that the thermal resistance due to dislocations in LiF is three orders of magnitude greater than predicted by Klemens. For a screw dislocation τ^{-1} lacks the logarithm term so that the scattering is much smaller than for an edge dislocation.

539.2

10232. OPTICAL STUDY ON THE RESULTANT MOVEMENT OF MANY WALLS IN ROCHELLE SALT. R.Abe.

J. Phys. Soc. Japan, Vol. 13, No. 3, 244-9 (March, 1958).

A new optical device was constructed. It was found that the rotating angle of the optical plane is nearly in proportion to the spontaneous polarization. Some characteristics of the resultant wall motion were studied from the information of the rotating angle. From these experimental results it is concluded that the fatigue effect will be caused by either the displacement of dislocations or neutral vacancies.

539.2

10233. OSCILLATOR STRENGTH OF M-CENTRE OF KCl.

H.Okura.

J. Phys. Soc. Japan, Vol. 12, No. 11, 1313-14 (Nov., 1957).

By F-band irradiation and by heat treatment, conversion of F- to M-centres, and the reverse process, can be effected and from the characteristics the M-centre oscillator strength can be determined. Assuming 0.83 for the oscillator strength of the F-centre, a value of 0.34 ± 0.01 is obtained for the M-centre.

G.F.J.Garlick

539.2

10234. ELECTRON MICROSCOPIC OBSERVATION OF COLOURED AND BLEACHED ALKALI-HALIDE CRYSTALS.

T.Hibi and H.Ishikawa.

J. Phys. Soc. Japan, Vol. 13, No. 7, 709-16 (July, 1958).

Alkali halide crystals coloured by X-ray irradiation were observed using replica techniques. Crystals bleached by keeping them in air and by thermal treatment were also observed. Growth of crystallites was seen not only on the irradiated front face, but also on the side face and on the newly cleaved section. An interesting growth of crystallites was observed all over the front face with the progress in coloration. It was also seen on the side face that the growth of crystallites similar to that on the front face ocurred in accordance with the degree of coloration. At the inner part of a coloured crystal, growth of crystallites was observed only along the steps or in the neighbouring part. By a process opposite to the crystal growth in coloration, crystallites grown during coloration disappeared in the process of bleaching. The results are discussed.

539.2 : 535.371

10235. LUMINESCENCE AND DICHROISM OF F AND M CENTERS IN POTASSIUM CHLORIDE. G.Kuwabara and A.Misu.

J. Phys. Soc. Japan, Vol. 13, No. 9, 1038-47 (Sept., 1958).

In order to determine the model of the M-centre, the luminescence and dichroism of additively coloured KCl were studied in detail. The polarization factors of luminescence due to M-centres excited with polarized light in the F-band are $P(\pi/4) = -0.37$ and $P(0) = -0.17$. The F-band, as well as the M-band, becomes dichroic by irradiating with polarized light in the M-band at room temperature, or in the F-band at low temperature, and the same quantitativ relation exists between the amounts of dichroism in the F- and M-band for both cases. These results do not contradict the hypothesis that the second M-band overlaps with the F-band. If this assumption is granted, it is concluded from the experiment that the symmetry type of the M-centre is not C_{2v} but D_{2h}. The oscillator strengths were found to be 0.65 and 0.53 of that of the F-band. If the emission due to M-centres excited with light in the F-band is assumed to be caused by the resonance transfer from F- to M-centres, in order to explain the experimental value of transfer probability, th distance between both centres must be less than the order of 10 A.

539.2

10236. ON THE V-CENTERS IN KBr CRYSTALS. Y.Nakai.

J. Phys. Soc. Japan, Vol. 13, No. 12, 1424-31 (Dec., 1958).

The nature of V-bands in additively coloured crystals of KBr was investigated. Mollwo's results were confirmed and extended. A new technique of additive colouring was devised to produce a high concentration of V-centres in KBr. By using this method, the degre of coloration could be increased by about ten times that reported by Mollwo. Besides the well-known V_2- and V_3-bands, another band of V-type was observed below 210 mμ. It was found possible to colour KBr electrolytically, revealing the same absorption spectrum as that of additively coloured crystals. Evidently, this confirms that these absorption bands are produced as the result of the combination of positive holes and positive ion vacancies. Comparison is made with the results obtained for KBr coloured with X-rays.

539.2

10237. THE ELECTRONIC STRUCTURE OF THE M CENTER.

H.Mimura and T.Inui.

J. Phys. Soc. Japan, Vol. 14, No. 2, 175-9 (Feb., 1959).

The electronic structure of the M-centre for LiF was investigated by LCAO apparoximation, assuming an L-shape model by Seitz. In this treatment, the authors have orthogonalized the wave-function of the M-electron to the core state of the Li ion, and evaluated the three centre integrals more accurately than in previous work. The calculated value for the M-band absorption is 0.078 compared with the experimental value 0.103 in atomic units. The approximation and symmetry problems are discussed.

539.2 : 538.2

10238. PARAMAGNETIC RESONANCE OF COLOR CENTERS IN GERMANIUM-DOPED QUARTZ. J.H.Anderson and J.A.Weil.

J. chem. Phys., Vol. 31, No. 2, 427-34 (Aug., 1959).

Measurements of the paramagnetic resonances in single crysta of X-irradiated germanium-doped quartz have been carried out. T g tensors have been obtained and the hyperfine structure has been partially interpreted. Two radiation-damage centres are found wit similar structures. A model for the centres is suggested, consisti of an unpaired electron located on an impurity centre composed of substitutional germanium atom surrounded by four oxygen atoms with an alkali ion in an adjacent interstitial position on a twofold axis.

539.2 : 535.37

10239. ONE-DIMENSIONAL CONFIGURATIONAL CO-ORDINATE CURVES FOR LUMINESCENCE CENTERS. K.Maeda.

J. Phys. Chem. Solids, Vol. 9, No. 3-4, 335-6 (March, 1959).

The relation between one-dimensional and multi-dimensional co-ordinate curves for emission centres are discussed. The agreement between theory and experiment for the one-dimensional case in some circumstances is shown not to give general validity to suc restricted treatment. This particularly applies to prediction of e activation energy for non-radiative transitions.

G.F.J.Garlick

539.2 : 535.371

POLARIZED LUMINESCENCE OF COLOURED CRYSTALS. ee Abstr. 9468

539.2 : 535.377

THERMOLUMINESCENCE AND F-CENTRES. See Abstr. 9497-8

539.2

0240. INTERACTION OF EXCITON WITH ELECTRON TRAPPING ENTERS IN ALKALI HALIDE CRYSTALS. I. F AND U CENTERS N KCl AND KBr CRYSTALS. M.Ueta, M.Hirai and H.Watanabe.
. Phys. Soc. Japan, Vol. 14, No. 3, 253-61 (March, 1959).

The quantum efficiency for the bleaching of F centres in the Cl crystal with incident ultraviolet light in the region of the ndamental absorption band was found to be five times larger an that with the visible light in the F-absorption region. With the stimation of the absorption coefficient of the crystal at the fundaental absorption edge it is inferred that one exciton can bleach at east six F centres. From measurements of the quantum efficiency or the U → F transformation using monochromatic light, it is conluded that one exciton is able to transform about three U centres. ependence of the quantum efficiency on the wavelength of exciting ight was determined in the KBr crystal.

539.2 : 535.371

ELECTRON TRAPS IN ZINC SULPHIDE PHOSPHORS. ee Abstr. 9474

539.2

0241. INTERACTION OF EXCITATION WAVES IN A ONE-IMENSIONAL CRYSTAL. R.E.Merrifield.
, chem. Phys., Vol. 31, No. 2, 522-5 (Aug., 1959).

The problem of exciton—exciton interaction in molecular rystals is discussed in terms of the stationary two-quantum excited tates of an idealized one-dimensional crystal. If only a single nolecular excited state is considered, the wave functions and energy evels of the two-quantum states may be obtained directly from those f the corresponding one-quantum problem with the proviso that the wo excitons have different wave number. If in addition, a second nolecular excited state is included, there can exist states in which wo excitons remain bound to each other as they propagate through he crystal.

539.2

0242. ELECTRON—LATTICE EQUILIBRIUM STATES IN ISTORTED CRYSTALS. E.Fues and H.Stumpf.
Z. Naturforsch., Vol. 14a, No. 2, 142-53 (Feb., 1959). In German.

See Abstr. 2299, 5080 (1955), 6267 (1959). Wave-functions for lectrons in distorted crystal lattices are considered, neglecting attice vibrations. The method of calculation is applied to ionic rystals, where the influence of electron polarization is taken into ccount; and to F-centres in NaCl crystals. A.R.Stokes

539.2 : 535.343

10243. EXCITON AND PHONON EFFECTS IN THE ABSORPTION SPECTRA OF GERMANIUM AND SILICON.
G.G.Macfarlane, T.P.McLean, J.E.Quarrington and V.Roberts.
J. Phys. Chem. Solids, Vol. 8, 388-92, 421-2 (Jan., 1959).

Rochester Semiconductors Conference Paper (See Abstr. 4569 of 1959). Evidence for exciton creation in Ge and Si by indirect and direct transitions has been obtained from high resolution absorption spectra. At low levels of absorption fine structure is observed, which is characteristic of indirect transitions involving the emission and absorption of phonons. For Ge four different phonons with energies of 90°K, 320°K, 350°K and 420°K and for Si four phonons with energies 212°K, 670°K, 1050°K and 1420°K contribute to the absorption. They correspond with the TA, LA, LO,and TO vibrational modes respectively. Each component is interpreted as being due to the formation of excitons and free electron—hole pairs. The exciton binding energy is found to be about 0.0027 eV for Ge and about 0.010 eV for Si. Absorption to the first excited state of the exciton is also observed. This state is estimated to be about 0.0010 eV above the ground state for Ge and 0.0055 eV for Si. The structure of the exciton absorption is smoothed out as the temperature is raised. The effect is explained as due to a temperature dependent relaxation time for the excitons. Direct exciton transitions have been observed as a line structure at high levels of absorption in Ge. By taking into account the Coulomb interaction of the electron and hole in the theory of the direct band-to-band absorption, the energy dependence of the absorption above the exciton line can be explained and a value of about 0.0012 eV obtained for the exciton binding energy.

539.2

10244. ON THE THEORY OF THE MOTT EXCITON IN ALKALI-HALIDE CRYSTALS. S.A.Moskalenko.
Optika i Spektrosk., Vol. 5, No. 2, 147-55 (1958). In Russian.
English summary: PB 141047T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

A discussion of the many-electron theory of the exciton. The properties of the exciton band depend on those of the valence and conduction bands, on their interaction, and on certain functions which describe the bound state of an electron and a hole.

L.Pincherle

539.2

10245. THE ENERGY SPECTRUM OF THE MOTT EXCITON IN IONIC CRYSTALS. S.A.Moskalenko and K.B.Tolpȳgo.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 149-63 (1959). In Russian.

A qualitative study of Mott exciton levels in ionic crystals is made on the basis of many-electron theory. A many-electron investigation of the exciton reduces to the problem of the motion of two quasi-particles which interact with Coulomb forces in the case of triplet states (ortho-exciton) and with Coulomb and exchange forces in the case of singlet states (para-exciton). These forces are approximately calculated with aid of a model which assumes spherical symmetry of the state of an electron at the cation site and of the vacant state in the anion. The ortho- and para-exciton series of an unpolarizable exciton of large radius are computed by the generalized effective mass method. The influence on l splitting of deviation of the potential from a point Coulomb potential is estimated. A general level scheme of the exciton for K = 0 is presented for the O_h group on basis of group considerations and the results are compared with the yellow exciton series in the Cu_2O crystal. The properties of an exciton in a magnetic field are discussed.

539.2

10246. EXCITON ENERGY IN ALKALI HALIDE CRYSTALS.
I.M.Dȳkman and A.A.Tsertsvadze.
Zh. eksper. teor. Fiz., Vol. 34, No. 5, 1319-21 (1958). In Russian.
English summary: PB 141052T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The model introduced in Abstr. 10646 (1954) is extended by the introduction of the wave-functions for the ground state and excited state of the crystal, to permit the calculation of quantities associated with the exciton transition. Computation by this method for NaCl gives the energy of the transition as 7.5 eV, agreeing reasonably with the experimental value, 7.85 eV. J.Hawgood

539.2

10247. THE INFLUENCE OF THE ELECTRON—PHONON INTERACTION ON THE CYCLOTRON RESONANCE FREQUENCY.
A.V.Tulub.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 565-73 (1959). In Russian.

This interaction in polar crystals gives rise to the nonlinear dependence of the cyclotron resonance frequency on the magnetic field. The calculation of these terms shows that they are small for practically used fields. The polaron effect leads also to a correction in the diamagnetic susceptibility. The mass renormalization in the presence of the magnetic field is performed without assuming the coupling constant to be small.

539.2 : 538.27

SPECTRAL DIFFUSION, PHONONS, AND PARAMAGNETIC SPIN-LATTICE RELAXATION. See Abstr. 9803

539.2

10248. BOSON EXCITATIONS IN IONIC CRYSTALS.
M.Sh.Giterman, P.S.Zȳryanov and G.G.Taluts.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1532-7 (1958). In Russian.

In the second quantization representation, a study is made of boson elementary excitations of a system of excitons interacting with polarization vibrations of a crystal. In the case of weak coupling, the interaction leads to a decrease of the exciton energy and to an increase of its effective mass. These effects are estimated quantitatively.

539.2

10249. ON THE USE OF HARMONIC OSCILLATOR WAVE FUNCTIONS IN THE TREATMENT OF ANHARMONIC CRYSTALS. T.H.Walnut.

J. chem. Phys., Vol. 31, No. 2, 361-5 (Aug., 1959).

An analysis is made of the quantum-mechanical treatment of a crystal as a perturbed harmonic oscillator. The relative magnitudes of the elements of the Hamiltonian matrix, with harmonic oscillator wave-functions as a basis, are obtained for an anharmonic crystal. It is found that the harmonic oscillator wave-functions are extremely poor approximations (in the ordinary sense) to the true wave-functions.

539.2

10250. THE FUNDAMENTAL FREQUENCIES OF LATTICE VIBRATION OF CALCITE, DOLOMITE AND MAGNESITE, ACTIVE IN ABSORPTION. J.Louisfert.

C.R. Acad. Sci. (Paris), Vol. 248, No. 8, 1150-3 (Feb. 23, 1959). In French.

The fundamental frequencies between 80 and 400 cm^{-1} were determined from absorption and reflection measurements. The mean of each corresponding vibration frequency of calcite and magnesite lies near a frequency observed in dolomite.

B.T.M.Willis

539.2

10251. EXTENSION OF DAVYDOV'S THEORY OF MOLECULAR CRYSTALS TO VIBRONIC TRANSITIONS. W.A.Bingel.

Canad. J. Phys., Vol. 37, No. 5, 680-1 (May, 1959).

The analysis in Abstr. 6607 (1955) is modified to include effects of molecular vibration. The band splitting is different for each vibronic transition, but the order of the split components and the band shift are unaffected by the inclusion of vibration.

J.Hawgood

539.2

10252. CALCULATION OF THE ENERGY BAND STRUCTURE OF THE β-SiC CRYSTAL BY THE ORTHOGONALIZED PLANE WAVE METHOD. S.Kobayasi.

J. Phys. Soc. Japan, Vol. 13, No. 3, 261-8 (March, 1958).

The energy band structure of the β-(zincblende-type) SiC crystal is worked by the orthogonalized plane wave (OPW) method. Since this crystal will be the typical one of the IV—IV compounds, the results of calculation for its electronic structure will be useful for systematic understanding of the transitions of the electron-behaviour from the group-IV valence-crystals to the III—V compounds etc. The results show that the conduction band-mimina occur at X-point or its immediate neighbour, while the valence band-maximum perhaps at Γ-point. Hence the indirect interband-transitions in the long wave limit will be expected to occur between these two states with the energy difference of 2.2 eV, and the direct interband-transitions at X-point will take place at a photon energy of 6.3 eV. Further, the approximate charge-distribution in the crystal is worked by making use of the obtained Γ-valence eigenfunctions, which result seems to show that the electrons in its $\vec{k} = 0$ levels of the β-SiC will be approximately a covalent-like distribution as far as Γ-eigenfunctions are concerned. Finally, an idea is proposed to improve the slow-convergence of the OPW method for conduction bands of insulators. Its practical application is now in progress for the β-SiC.

539.2 : 538.2

10253. ELECTRONIC STRUCTURE AND DIAMAGNETISM OF GRAPHITE. S.Mase.

J. Phys. Soc. Japan, Vol. 13, No. 6, 563-73 (June, 1958).

The electronic energy bands were studied by the Bloch method, and the diamagnetic susceptibility calculated. The calculated value of the main term in Peierls' constant susceptibility (component parallel to c-axis is about 0.3 times the experimental value, and the theoretical value of periods (on the basis of Onsager's theory) of two types with regard to the de Haas—van Alphen effect is about 2.5 times the experimental value. The cause of such discrepancy is discussed.

539.2

10254. THE ELECTRON ENERGY SPECTRUM IN A NON-IDEAL METAL LATTICE. V.L.Bonch-Bruevich and V.B.Glasko.

Dokl. Akad. Nauk SSSR, Vol. 124, No. 5, 1015-17 (1959). In Russian.

Interstitial hydrogen-like atoms in the metal lattice are considered and the changes in energy and electron density are calculated by a method previously developed by the author (Abstr. 5266 of 1956; 1885 of 1957), in which the single particle density matrix follows from the Fermi Green's function for the system. The frequencies which appear in the spectral expansion of the Green's function are the eigenvalues of a certain equation, which is solved by computer in a particular case. It is shown that the method can be applied in a practical calculation.

M.G.Priestley

539.2

10255. THE SPIN HAMILTONIAN FOR INTERACTION OF A LOCALIZED ELECTRON IN A CRYSTAL WITH NUCLEAR MAGNETIC MOMENTS. V.Ya.Zevin.

Optika i Spektrosk., Vol. 3, No. 6, 660-4 (Dec., 1957). In Russian.

A general expression is obtained for the spin Hamiltonian of interaction between a localized electron and magnetic moments of the surrounding nuclei in a crystal lattice. The case when the smoothed wave-function of an impurity centre in a crystal is spherically symmetrical is discussed in detail. Expressions for the spin Hamiltonian coefficients are obtained and the Hamiltonian for an F-centre is discussed.

A.Tybulewicz

539.2

10256. ELECTRONIC STRUCTURE OF BISMUTH TYPE CRYSTALS. S.Mase.

J. Phys. Soc. Japan, Vol. 13, No. 5, 434-45 (May, 1958).

A study is made of calculating the electronic energy bands in bismuth type crystals by making use of the Bloch method (with the inclusion of spin—orbit interaction) for the purpose of clarifying the relation between the low temperature diamagnetic susceptibility and the energy bands. The peculiar feature of the de Haas—van Alphen effect in bismuth type crystals (the small effective mass tensor) is explained by the calculated energy bands but the ordinary main term of the Landau—Peierls susceptibility expected from the energy bands is small compared with the experimental value. Then, unlike Jones' theory, most of the extraordinarily large constant susceptibility seems to be attributed to the non-diagonal term which is usual neglected.

539.2

10257. THE HYDROGEN-LIKE SYSTEM WITH PARTIALLY SCREENED COULOMB POTENTIAL.

I.Z.Fisher and V.I.Krȳlovich.

Zh. tekh. Fiz., Vol. 27, No. 6, 1289-93 (June, 1957). In Russian. English translation in : Soviet Physics — Technical Physics (New York), Vol. 2, No. 6, 1184-8 (June, 1957).

The Schrödinger equation is solved for the motion of an electron or a hole, in a partially screened Coulomb field, assuming the effective masses of electrons and holes and the dielectric permeability of the crystal are isotropic. The variations of the binding energies of the 1s, 2s, 2p and 3d states with the screening parameter are calculated. Application of the theory to specific phenomena in metals and semiconductors is given elsewhere.

G.C.Williams

539.2 : 539.19

10258. POLYTYPISM AND THE ORIGIN OF THE POTENTIAL BARRIER HINDERING INTERNAL ROTATION IN MOLECULES.

W.Weltner, Jr.

J. chem. Phys., Vol. 31, No. 1, 264-5 (July, 1959).

An attempt has been made to remove some of the uncertainties connected with the explanation of polytypism and random stacking faults.

R.A.Ballinger

539.2

10259. AN APPLICATION OF THE CELLULAR METHOD TO A VACANCY IN METAL. H.Fujiwara.

J. Phys. Soc. Japan, Vol. 13, No. 8, 935-9 (Aug., 1958).

The distribution of electrons around a vacancy in a metal is studied using a model which was introduced in a previous paper. Th arrangement of the nuclei of a matrix metal at each lattice point, except where the nucleus is missing (vacancy), is treated by the cellular method. The deviation of the potential in the cells neighbouring the vacancy, from the periodic one for the pure metal, is taken into account. In the first approximation, the lattice distortion due to the vacancy is neglected. The Thomas—Fermi equation, in which all the electrons are taken into account, is solved numericall in each cell and connected smoothly by a suitable set of boundary conditions. Calculations for the case of a vacancy in copper show t there is the charge of −1.7e inside the atomic sphere for the vacanc

539.2

SINGLE-PARTICLE ENERGIES IN A DEGENERATE
TRON GAS AT HIGH DENSITY. R.M.Rockmore.
Rev., Vol. 114, No. 4, 941-5 (May 15, 1959).

xpressions for the self-energy of an electron and the physical
ropagator for an excited electron plus hole in a degenerate
on gas at high density are obtained through the formulation of
ivalent Hamiltonian for the problem. These expressions are
al to those obtained by Quinn and Ferrell (Abstr. 6244 of
A derivation of the physical pair-propagator from ground
considerations is also given.

539.2

POLARIZATION OF THE ELECTRON GAS IN METALS
BSTITUTIONAL IMPURITIES. B.D.Silverman and P.R.Weiss.
Rev., Vol. 114, No. 4, 989-94 (May 15, 1959).

he ground-state energy of the system of impurities and con-
n electrons in a metal has been obtained in the high electron
y limit. The procedure used is an extension of the Wentzel
d applied to a reduced Hamiltonian which includes an electron—
ity interaction. It is reduced in the sense that the Coulomb
ction between electrons and the electron—impurity interaction
ly effective in raising an electron in a state below the Fermi
to one above and vice versa. The ground-state energy is then
ed by a canonical transformation. The shift in energy of the
d state of the electron gas, due to the introduction of the im-
es, is quadratic in the electron—impurity matrix element.
r order processes in this matrix element do not contribute
they are represented by unlinked diagrams. Considering this
n the ground-state energy expandable in powers of r_s, a
ire of the average inter-electronic distance, it is shown that the
g or lowest order term in this parameter varies as $(n/n_e)r_s^{-\frac{1}{2}}$,
n is the impurity density and n_e the electron density. Impurity
ons are assumed random. All processes omitted in the re-
n of the Hamiltonian are shown to contribute to higher powers
The role of exchange is indicated.

539.2

EFFECT OF EXTERNAL STRESS ON THE DOMAIN
CTURE OF WO_3. S.Tanisaki.
ys. Soc. Japan, Vol. 13, No. 4, 363-6 (April, 1958).

O_3 is monoclinic at room temperature and has a domain
ture with walls of (110) and (100) twin planes. The (110) wall
placed sideways by a pressure externally applied along the
, resulting in a change of the axis b to the shorter axis a.
100) domains change to a single domain by stress X_z. The
domain crystal obtained in this way is used to determine the
elasticity axes of WO_3. Two peculiar types of domain structure
r by a pressure along the c axis, which can be understood as
ting from the change of the axis c to the axis a by the stress.
sensitivity of domain structure to the stress seems to be due
monoclinic and pseudosymmetric structure of this crystal.

539.2 : 539.18

. COMMENT ON T.B.GRIMLEY'S PAPER "THE
CULAR ORBITAL THEORY OF THE INTERACTION
VEEN AN ATOM AND A CRYSTAL SURFACE". J.Koutecký.
Phys. Soc., Vol. 73, Pt 2, 323 (Feb., 1959).

is pointed out that much work on chemisorption of similar
o that referred to in Abstr. 5476 (1958) has been published by
thor and various colleagues. Some of their results agree
hose of Grimley. C.A.Hogarth

539.2 : 538.2

. CONCERNING THE SYNTHESIS OF THE SHAPE OF THE
I SURFACE IN METALS. M.Ya.Azbel'.
sper. teor. Fiz., Vol. 34, No. 3, 754-5 (1958). In Russian.
h translation in: Soviet Physics — JETP (New York),
4(7), No. 3, 518-19 (Sept., 1958).

ifshits and Pogorelev suggested a method of synthesis from
tremal cross-sections S_{ext} of the surface, determined from
riods of the de Haas—van Alphen oscillations of the magnetic
ptibility. A method is here proposed, based on observations
de Haas—van Alphen effect on films, by means of which S_{ext}
e radius vector p can be determined directly as functions of
rection $\underline{p}/p$ for various harmonics. It utilizes the fact that
plitude of the oscillations is larger when the orbit correspon-
o the extremal cross-section is in the plane of the film, so
he effective electrons do not collide with the surface.
L.Pincherle

539.2 : 537.311.31

10265. THE EFFECT OF UMKLAPP PROCESSES ON THE ELECTRICAL RESISTANCE OF METALS AT LOW TEMPERATURE. H.Pfennig.
Z. Phys., Vol. 155, No. 3, 332-49 (1959). In German.

Bloch's integral equation is solved under the assumption of a rigidly displaced electron distribution and thermal equilibrium of the lattice, yielding the following results. If the Fermi surface $E(k) = \zeta$, periodically repeated in k-space, consists of closed separate parts which are very near to each other (distance q^*), then the transitions between two neighbouring surfaces (umklapp processes) make — especially at rather low temperatures — a large contribution to the electrical resistance. In simple cases, the temperature dependence is given by $\rho_{UP} \sim$ polynomial $(T/\Theta^*)\ e^{-\Theta^*/T}$. Calculations were performed for alkali metals taking into account their anisotropic elastic behaviour. It was found that the contribution of the umklapp processes could be as high as 100 times that of the normal processes. The agreement between theory and experiment is satisfactory, excepting Li.

539.2 : 535.39

10266. THE OPTICAL PROPERTIES OF NOBLE METALS. M.Suffczynski.
Proc. Phys. Soc., Vol. 73, Pt 4, 671-4 (April, 1959).

Reports a calculation of the extinction coefficient k in which inter-band transitions between states near the hexagonal face of the Brillouin zone are considered. Theoretical curves for Cu and Ag showing k/λ as a function of wavelength λ are compared with the experimental data of Schulz (Abstr. 7025 of 1957). The dip in the k/λ curves is related to the increased density of states near the zone boundary but it is not possible to decide whether the Fermi surface touches the zone boundary. D.M.Edwards

539.2

10267. THE g-VALUE OF S-STATE IONS.
I.Fidone and K.W.H.Stevens.
Proc. Phys. Soc., Vol. 73, Pt 1, 116-17 (Jan., 1959).

It is pointed out that the effects of covalent bonding can give rise to positive contributions to g, although the previous crystal field theory of the g-value of S-state ions predicts that g will always be less than the value for free electrons. C.A.Hogarth

539.21

10268. NORMAL COORDINATES FOR [A DESCRIPTION OF] RETARDATION INTERACTIONS IN CRYSTAL LATTICE.
V.S.Mashkevich.
Dokl. Akad. Nauk SSSR, Vol. 121, No. 2, 247-9 (1958). In Russian.

The motion of the particle suffering retardation in the crystal lattice is described in terms of two basic vectors u_s^l and p_s^l; the former representing position, the latter dipole moment, and the super- and subscripts referring, respectively, to the cell and atom densities in the lattice. The interaction Hamiltonian and energy-transfer between the particle and the lattice are described in terms of the new coordinate. Although the present paper is concerned with electromagnetic interactions the formalism is not limited to these and may be extended, e.g. to describe the retardation of neutrons in a graphite lattice. J.W.Gardner

539.21

10269. PRECIPITATION OF HELIUM IN NEUTRON IRRADIATED BERYLLIA. H.Frisby, A.Bisson and R.Caillat.
C.R. Acad. Sci. (Paris), Vol. 248, No. 5, 672-3 (Feb. 2, 1959).
In French.

Electron microscopic examinations were carried out on replicas from fractured surfaces of beryllia after irradiation with fast neutrons and after subsequent thermal treatments. Observations were made of the formation, growth and evolution of bubbles inside the solid sample. J.Adam

539.21

10270. EFFECTS OF NEUTRON-INDUCED GAS FORMATION ON BERYLLIUM. C.E.Ells and E.C.W.Perryman.
J. nuclear Mater., Vol. 1, No. 1, 73-84 (April, 1959).

Specimens of beryllium which had received neutron irradiations up to an integrated fast flux of 10^{22}nvt have been examined after annealing at various temperatures. For beryllium which had received the maximum irradiation, the annealing treatments have resulted in significant decreases in overall density of the beryllium specimens, the density decrease being 0.8% and 20% after annealing individual specimens for one hour at 595° and 995°C, respectively. The quantity of neutron-induced gases contained in the beryllium has been shown to be approximately 23 cm^3 gas per cm^3 metal for the integrated fast flux of 10^{22} nvt. Analysis of the gas shows that it is mainly He^4. Metallographic evidence confirms that the density decreases are a direct result of void formation in the metal; it is concluded that the voids contain He^4 at pressures high enough to cause growth of the voids at the annealing temperatures. The detailed results of the constituent analysis of the neutron-induced gas confirm that the greater part of the gas arises from the (n,2n) capture reaction on beryllium.

539.21

10271. THE EFFECTS OF HEATING NEUTRON IRRADIATED BERYLLIUM. J.B.Rich, G.B.Redding and R.S.Barnes.
J. Nuclear Mater., Vol. 1, No. 1, 96-105 (April, 1959).

Small pieces of a beryllium shim rod from the Harwell M.T.R. were heated and changes in microstructure, volume and mechanical properties observed. The beryllium which was estimated to have received a dose of about 7.6×10^{21} fast neutrons/cm^2 contained about 10 cm^3 at N.T.P. of helium per cm^3 and this precipitated as fine gas bubbles during heating for an hour at temperatures above 600°C. These bubbles grew, particularly at the grain boundaries, during further heating, until at 1100°C they were about 10^{-3} cm diameter. The precipitation and growth of the bubbles produced an increase in the volume of the samples, commencing at about 600° C and eventually reaching 30% at 1000°C. The irradiated beryllium is very brittle, even above room temperature, and this may be aggravated by the large gas bubbles lying on the grain boundaries. The observations are discussed in relation to those already reported for beryllium containing large local concentrations of helium injected with a cyclotron.

539.21

10272. REVERSIBLE EFFECTS OF RADIATION ON MECHANICAL PROPERTIES OF POLYMERS.
M.A.Mokul'skii, Yu.S.Lazurkin, M.B.Fiveĭskii and V.I.Kozin.
Dokl. Akad. Nauk SSSR, Vol. 125, No. 5, 1007-10 (April 11, 1959).
In Russian.

The following effects were observed during irradiation in a nuclear reactor (doses up to hundreds of megarads, dose rates up to 50 000 rad/sec): (1) lowering of the mechanical strength of polymethylmethacrylate; (2) lowering of the elasticity limit of polyvinyl chloride; (3) increase of the extension at rupture in polyvinyl chloride; (4) increase of the rate of relaxation of stresses in all the materials studied (polystyrene, nitrile and natural rubber, polyisobutylene, polytetrafluorethylene, polymethylmethacrylate, plasticized and unplasticized polyvinyl chloride); (5) increase of the creep rate in polyvinyl chloride, polystyrene, polytetrafluorethylene and rubbers. All these effects disappear when radiation ceases. The effects may be due to local heating which, although intense, is not sufficient to produce permanent changes, or may be due to reversible rupture of bonds. A.Tybulewicz

539.21

10273. IRRADIATION OF POLYETHYLENE. III. INFLUENCE OF TEMPERATURE AND PHASE. T.F.Williams and M.Dole.
J. Amer. Chem. Soc., Vol. 81, No. 12, 2919-26 (June 20, 1959).

Gamma-ray irradiation of the linear polyethylene, Marlex-50, above the melting point yields a higher evolution of hydrogen, a greater degree of cross-linking and of vinylene double bond production than irradiation at room temperature. The infrared band at 10.1 μ is missing in the case of the 142° irradiated polyethylene, and the crystallization ability is reduced. Vinyl and vinylene double bond decay constants are increased at the upper temperature, but not markedly so. G-values for vinylene decay in the case of Marlex-50 containing 5% of trans-1,4-poly-(butadiene) are as high as 50.6 groups decayed per 100 eV of energy absorbed in the whole sample, but gel formation remains unchanged, leading to the postulate of vinylene decay in this mixture by intramolecular coupling. Material balance between hydrogen evolution, crosslinking and double bond formation is approached in the case of Marlex-50 at both 25 and 142° by allowing for a calculated increase in the weight average molecular weight due to endlinking. It is concluded that both M_n and $\overline{M}_w$ increase by the factor $[Vi]^0/[Vi]$ as endlinking occurs. Material balance is not achieved in the case of a low density polyethylene. At the gel point of the latter the decrease in vinylidene unsaturation is estimated to be almost four times as great as cross-links produced, a fact which suggests that vinylidene groups are located near the ends of the molecules. A post-irradiation fusion of vacuum irradiated Marlex-50 causes a greater vinyl decay, increased vinylene group formation and a greater G-value for crosslinking. These facts suggest strongly that cross-linking can occur by rearrangement segments containing free radicals as well as by C–C bond form during the radiolytic detachment of hydrogen. The trans-1,4-po (butadiene) lowers $G(H_2)$ and G(-Vi) at 142°, but the latter more the former; cis-1,4-poly-(butadiene) has a smaller effect. At r temperature the protective action of the poly-(butadiene) seems much less, probably because of non-uniform mixing in the solid

53

10274. EFFECTS OF IONIZING RADIATIONS ON POLYVINYL ALCOHOL. I. BREAKDOWN OF MAIN-CHAIN AND FORMATIO OF CARBONYL GROUPS. A.Danno.
J. Phys. Soc. Japan, Vol. 13, No. 6, 609-13 (June, 1958).

Polyvinyl alcohol in the form of film and powder was irradi in air by gamma rays from a cobalt-60 source, and by deuterons accelerated by a cyclotron. Weight changes, viscosity, solubility and infrared absorption spectra of irradiated samples were mea ured as a function of absorbed dose. A reduction of the molecul weight of the irradiated specimens was observed, suggesting tha the effect was one of degradation. Infrared absorption spectra showed the formation of the carbonyl groups in the irradiated sp men.

53

10275. EFFECTS OF IONIZING RADIATION ON POLYVINYL ALCOHOL. II. CHANGES OF PHYSICAL PROPERTIES OF THE IRRADIATED SPECIMEN CAUSED BY HEAT TREATMENT. A.Danno.
J. Phys. Soc. Japan, Vol. 13, No. 6, 614-17 (June, 1958).

For Pt I, see preceding abstract. The physical properties polyvinyl alcohol irradiated by deuterons or gamma rays were found to change remarkably by heat treatment. Irradiation caus a decrease of the molecular weight and an increase of the carbo groups. When these specimens are heated above 120°C, howeve the solubility diminishes considerably and even gel formation oc for highly irradiated specimens. Infrared absorption spectra re vealed that the number of carbonyl groups formed by the irradia decreased greatly as a result of heat treatment. Some discussi is given on the process of gel formation.

539.21 : 53

THE EFFECT OF HIGH ENERGY RADIATION ON POLYMERS. See Abstr. 10211-13

53

10276. RADIATION EFFECTS IN MATERIALS. H.Brooks.
J. appl. Phys., Vol. 30, No. 8, 1118-24 (Aug., 1959).

A review is given of the mechanisms of radiation damage, a of some of the resulting effects. The discussion is divided into categories: (1) mechanisms of damage production, (2) nature an mobility of the imperfections produced, (3) effect of the imperfe on the measurement of the properties of the solid. Principal att tion is given to metals, with related observations in semiconduc cited.

539.21 : 537.3

10277. ANNEALING OF RADIATION DEFECTS IN SEMICONDUCTORS. W.L.Brown, W.M.Augustyniak and T.R.Waite.
J. appl. Phys., Vol. 30, No. 8, 1258-68 (Aug., 1959).

Radiation induced defects studied through changes in condu ivity and Hall coefficient have been observed to anneal in a num of different temperature ranges. Only those processes occurin above 80°K and involving defects created by electron irradiatio considered here. It has been found that the first annealing proc in n-type germanium occurs at about 50°C and is structure sens ive, apparently to the original chemical donor impurity. Higher temperature annealing processes, observed at about 200°C and previously interpreted as due to direct annihilation of vacancie and interstitials must also be sensitive to other crystal defects p-type germanium there is a process of rearrangement of a def centre at about 200°K, exhibiting first order kinetics, but with a constant which is strongly dependent upon the charge state of th defect. At about 120°C the defects in p-type apparently anneal completely, in striking contrast to the n-type case. Less exten silicon measurements, showing lifetime recovery between 200° 400°C again indicate through their kinetics the importance of ot impurities or defects in the annealing process.

539.21 : 537.3

10278. ENERGY LEVELS IN IRRADIATED GERMANIUM. E.I.Blount.
J. appl. Phys., Vol. 30, No. 8, 1218-21 (Aug., 1959).

The energy levels found in germanium irradiated by differ

les seem at first to be mutually inconsistent. It is possible
ively to reconcile the differences by consideration of clustering
ssociation of defects. Four levels are ascribed to single vac-
s and interstitials. A crude theory is contructed to explain
levels, particularly their asymmetrical distribution in the
y gap, and to assign each to a definite defect. This theory
s somewhat from a previous one due to James and Lark-
itz (Abstr. 1780 of 1952); some differences in experimental
ctions are discussed in particular.

539.21 : 537.311.33

. RADIATION-INDUCED ENERGY LEVELS IN SILICON.
lein.
l. Phys., Vol. 30, No. 8, 1222-31 (Aug., 1959).
adiation-induced energy levels in silicon have been detected,
oned, and evaluated with the help of many techniques. In this
, the presently available body of information has been organ-
summarized, and analysed. A short historical review pre-
a critical discussion of evidence recently reported for elec-
deuteron-, and neutron-irradiated silicon. Three conclusions
ge: (1) the energy level pattern is essentially independent of
maging agent; (2) the pattern seems to present a remarkable
etry with respect to the middle of the gap; (3) shallow levels
to the band edges are introduced in similar concentrations and
her rates than the deep traps. On this basis, an attempt is
to interpret the infrared absorption and photoconductivity data
and Ramdas. Problems such as those associated with the
e state of radiation-induced defect centres are examined in the
of a novel experimental approach.

539.21

. X-RAY AND EXPANSION EFFECTS PRODUCED BY
RFECTIONS IN SOLIDS: DEUTERON-IRRADIATED GER-
UM. R.O.Simmons and R.W.Balluffi.
pl. Phys., Vol. 30, No. 8, 1249-58 (Aug., 1959).
mportant information concerning atomic models of the defects
naged crystals can be obtained from measurements of bulk
changes, ΔL/L, and X-ray lattice parameter changes, Δa/a,
irradiation and subsequent recovery. These quantities are
ecessarily equal, and their magnitudes and signs may serve to
iminate between possible models. A detailed description of
L/L and Δa/a effects to be expected from models consisting of
imperfections (either uniformly distributed or clustered), dis-
ment spike regions, and dislocation loops is given. Additional
ssion is given of the effects expected in measurements of low-
X-ray scattering, Laue—Bragg reflection broadening, Laue—
reflection intensities, and X-ray diffuse scattering. The
ntly available experimental results on irradiated germanium
iscussed in an attempt to discriminate between the various
ls. Comparatively simple models consisting of clusters of
cies and clusters of interstitials are probably consistent with
nt experiment. No information is available regarding the shapes
se regions. More complicated models are not excluded, of
e. The aforementioned techniques are compared with electrical
urements in semiconductors, and some of the strengths and
esses of the various methods are assessed. The need for
r measurements of all types is emphasized.

539.21 : 537.311.33

1. LOW-TEMPERATURE ANNEALING STUDIES IN Ge.
MacKay and E.E.Klontz.
pl. Phys., Vol. 30, No. 8, 1269-74 (Aug., 1959).
rradiation at ~ 10°K using 1.10 MeV electrons produces very
rent changes in the electrical properties of n-type Ge as com-
with those produced in p-type Ge. In n-type Ge, more carriers
emoved per incident electron at 10°K than at 78°K. However,
50% of the removed carriers are recovered in two stages of
ling, at 34°K and 64°K, after low temperature irradiation.
iation at 0.315 MeV, after a 1.10 MeV irradiation, also produces
very of about 50% of the carriers removed by the 1.10 MeV
iation. In p-type Ge, low temperature irradiation is at least
imes less effective in removing carriers than is the case in n-
Annealing of an irradiated p-type sample to 130°K produces no
urable change. It is concluded that the stability of close-
cy-interstitial pairs against recombination is less in p-type
in n-type Ge. A qualitative argument as to the origin of this
ence in stability is presented.

539.21

10282. CROSS-SECTIONS FOR ATOMIC DISPLACEMENTS IN SOLIDS BY GAMMA RAYS. O.S.Oen and D.K.Holmes.
J. appl. Phys., Vol. 30, No. 8, 1289-95 (Aug., 1959).

Cross-sections for the displacement of lattice atoms by gamma-rays for energies up to 5 MeV were calculated. The principle contribution is found to come from the Compton effect, in which the atoms are displaced by electrons produced by the incident gamma-rays. The calculations were based on the assumption of a sharp threshold energy for displacement, but cross-sections were computed as a function of the assumed threshold energy. Thus, from the present work it is relatively easy to obtain cross-sections based upon other displacement functions.

539.21

10283. MEASUREMENTS OF UNIT CELL AND PHYSICAL DIMENSION CHANGES OF MOLYBDENUM AFTER NEUTRON IRRADIATION. J.Adam and D.G.Martin.
Phil. Mag. (Eighth Ser.), Vol. 3, 1329-32 (Nov., 1958).

In samples irradiated at 30°C to a dose of 2×10^{19} neutrons/cm^2 the fractional increase in length is approximately three times greater than the increase in unit cell size. It is suggested that at least one defect is mobile below the irradiation temperature and new lattice sites are created. Annealing experiments show a peak at 180°C and a broad peak at about 550°C. J.Adam

539.21 : 537.533

CHARGE DISTRIBUTION AND RANGE EFFECTS PRODUCED BY 3 MeV ELECTRONS IN PLEXIGLAS AND ALUMINUM. See Abstr. 9707

539.21 : 538.27

EPR STUDIES OF ELECTRON IRRADIATED ICE AND SOLID HYDROGEN. See Abstr. 9813

539.21 : 535.343

X-RAY IRRADIATION EFFECTS ON THE U.V. ABSORPTION OF $PbCl_2$ PLUS. See Abstr. 9446

539.21 : 535.372

X-RAY IRRADIATION EFFECTS ON THE ABSORPTION AND LUMINESCENCE SPECTRA OF NICKEL-ACTIVATED ALKALI HALIDES. See Abstr. 9484

STRUCTURE OF SOLIDS

539.213

10284. APPLICATION OF ARTIFICIAL ANISOTROPY TO DIRECTED FRACTURE OF MATERIALS (THE ARTIFICIAL "CLEAVAGE" EFFECT). V.L.Indenbom and I.I.Metelkin.
Kristallografiya, Vol. 3, No. 1, 80-3 (1958). In Russian. English summary: PB 141065T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A. English translation in: Soviet Physics—Crystallography (New York), Vol. 3, No. 1, 73-5 (Jan.-Feb., 1958).

An application of artificial anisotropy to the production of fracture in a predetermined direction is described, i.e. formation of an artificial cleavage plane along which binding between atoms or ions is weakened. An example of directed fracture is a glass tube which snaps easily at the point where it was earlier heated locally. The optimum fracture occurs in a narrow region which can be regarded as a cleavage plane. It was found that if a crack starts outside the artificial cleavage plane, it tends to grow in the direction of that plane. This "self-focusing" property is very useful in practice since it helps to achieve fracture at a pre-determined cross-section. Directed fracture can be achieved in tubes of varied shapes: from very wide tubes with thin walls to thick-walled tubes with a narrow bore.

539.213 : 535.343

STRUCTURE OF VITREOUS SILICA. See Abstr. 9438

539.213.2 : 548.5

10285. EFFECT OF CATALYST SIZE IN HETEROGENEOUS NUCLEATION. R.D.Maurer.
J. chem. Phys., Vol. 31, No. 2, 444-8 (Aug., 1959).

Light scattering and optical absorption have been used to study a photosensitive glass in which a gold colloid nucleates further crystallization. The depolarized component of the scattered light at 90° begins to increase abruptly after an elapsed time interval in the precipitation. This increase is attributed to a rapid increase in the nucleation catalysis by the gold colloid. The elapsed interval represents the time necessary for the gold colloid to grow to a size that is effective. In agreement with this, very high exposures, which produce very small colloid particles, result in little crystallization. The colloid size necessary for nucleation catalysis appears to be of the order of 80 angstroms. While this size may be connected with the critical size of the crystals that form on the gold colloid, an alternative explanation based on the curvature of small particles is also proposed.

539.215 : 535.39

INFLUENCE OF STRUCTURE ON OPTICAL PROPERTIES OF ALKALINE EARTH CARBONATES. See Abstr. 9501

539.215.9 : 531.36

AXIALLY SYMMETRIC MOTION IN SAND-LIKE SUBSTANCES. See Abstr. 9267

539.217

10286. DIFFUSION OF OXYGEN IN THE OXIDE OF VITREOUS GERMANIUM. V.G.Canina.

C.R. Acad. Sci. (Paris), Vol. 248, No. 9, 1319-22 (March 2, 1959). In French.

The absorption band at 2450 A is attributed to the presence of oxygen vacancies in the lattice of vitreous GeO_2, and the disappearance of this band on heating in air is attributed to the diffusion of vacancies to the surface, where they recombine with oxygen. The diffusion coefficient for this latter process was determined at 450°C by measuring the change in concentration of centres for different periods of heat treatment. B.T.M.Willis

539.217

10287. THE EFFECT ON THE DIFFUSION MOBILITY OF IRREVERSIBLE STRUCTURE CHANGES DUE TO PLASTIC DEFORMATION.

S.Z.Bokshtein, T.I.Gudkova, A.A.Zhukhovitskii and S.T.Kishkin.

Dokl. Akad. Nauk SSSR, Vol. 121, No. 6, 1015-18 (1958). In Russian.

The authors measured the change in the diffusion coefficient of tin in nickel caused by previous plastic deformation at 700°C by between 4.7 and 15.6%. After the deformation thin sections were electrolytically coated with radioactive tin and then annealed at 800°C. The volume and grain boundary diffusion coefficients were determined separately by an autoradiographic method. The results showed that the volume diffusion coefficient increased from 0.48 to 32×10^{-12} cm^2/sec at fracture, while the surface coefficient increased from 7.6 to 45.0×10^{-12} cm^2/sec. In a second experiment the strain was applied during the anneal and the change in total diffusion coefficient was similar to that in the surface coefficient in the previous experiment. A tentative interpretation of the results is given in terms of the mosaic structure of the alloy.

M.G.Priestley

539.217

10288. DIFFUSION-CONTROLLED REACTIONS IN SOLIDS. H.Reiss.

J. appl. Phys., Vol. 30, No. 8, 1141-52 (Aug., 1959).

Attention is focused on those aspects of the phenomena to which special care must be given in developing theoretical analyses. Several experimental examples are given, drawn from the chemical physics of semiconductors, e.g., annealing of radiation damage, ion pairing, precipitation, and the formation of complexes in solids.

539.217

10289. DIFFUSION OF CADMIUM INTO SINGLE CRYSTALS OF COPPER. T.Hirone, N.Kunitomi, M.Sakamoto and H.Yamaki.

J. Phys. Soc. Japan, Vol. 13, No. 8, 838-44 (Aug., 1958).

The diffusivity was measured in the temperature range from 725° to 950°C, using Cd^{115} as a tracer. The results indicate that $D_0 = 0.935$ cm^2/sec and H = 45 700 cal/mole. These values are compared with the corresponding values for the diffusion of zinc into copper, in order to investigate the effect of the difference in atomic radii.

539.217

10290. DIFFUSION OF COBALT INTO IRON—COBALT ALLOY. T.Hirone, N.Kunitomi and M.Sakamoto.

J. Phys. Soc. Japan, Vol. 13, No. 8, 840-4 (Aug., 1958).

The diffusivities of Co^{60} into 50-50 atomic percent alloy were measured by means of the lathe sectioning method for the temperature range including f.c.c. to b.c.c. phase transformation. The experimental values were expressed by

$$D = 1.1 \times 10^{-4} \exp(-41\,800/RT)\ \text{cm}^2/\text{sec for f.c.c. structure,}$$
$$D = 2.6 \times 10^{-6} \exp(-27\,400/RT)\ \text{cm}^2/\text{sec for b.c.c. structure,}$$

The activation energies for diffusion in the b.c.c. and f.c.c. lattices were compared with the theoretical values calculated by the approx mation of the closed shell repulsion with the Born—Mayer potentia It is concluded that the vacancy mechanism is responsible for the diffusion in the b.c.c. metal, in the same manner as in the f.c.c metal.

539.2

10291. DIFFUSION OF COBALT INTO SINGLE CRYSTALS OF COPPER. M.Sakamoto.

J. Phys. Soc. Japan, Vol. 13, No. 8, 845-7 (Aug., 1958).

The measurements were carried out in the temperature range from 950° to 700°C, using Co^{60} as a tracer. The result indicates that the diffusion coefficient is given by the equation

$$D = 5.7 \exp(-55\,200/RT)\ \text{cm}^2/\text{sec}$$

and, therefore, that the activation energy is appreciably larger tha that of copper self-diffusion. From this experiment, it has been definitely shown that, for the negative value of excess valency Z, the effect of screening on the solute diffusion in metals plays an effective role in the same manner as the effect observed for the positive value of Z.

539.21

10292. PREPARATION OF DIFFUSION COUPLES BY CATHODI SPUTTERING. R.Weil, S.J.Rothman and L.T.Lloyd.

Rev. sci. Instrum., Vol. 30, No. 7, 541-3 (July, 1959).

Apparatus and techniques are described for preparing metal diffusion couples by cleaning the sample surface and depositing an isotope layer by cathodic sputtering.

539.2

10293. THE NATURE OF THE SOLID SOLUTION OF BORON IN ALPHA IRON. A.K.Shevelev.

Dokl. Akad. Nauk SSSR, Vol. 123, No. 3, 453-6 (1958). In Russian.

From geometrical analysis of possible atomic packings, from the observed decreases in the period of the crystal lattice and in th density and from measurements of the X-ray line intensities, it is concluded that boron dissolved in alpha iron forms a substitutional and not an interstitial solid solution. The densities of Fe with 0, 0.08 and 0.13 weight per cent B were found to be 7.849, 7.810 and 7.800 and the lattice constants of the annealed materials 2.8623, 2.8619 and 2.86165 A, respectively. When quenched all the alloys had the same value of a, namely 2.8622 A. A.L.Macka

539.219 : 537.311.

10294. PRECIPITATION IN SEMICONDUCTORS. A.G.Tweet.

J. appl. Phys., Vol. 30, No. 8, 1244-8 (Aug., 1959).

A brief review is given of the present status of precipitation phenomena in semiconductors. Recent theoretical advances in the analysis of diffusion-limited precipitation are described. The pre cipitation of Li and Si is discussed as an example of diffusion-lim ted precipitation in which metastable centres are observed, and th precipitation of Cu as an example to which formal nucleation theo appears to apply. A recent theory of the clustering of oxygen in S is described and its significance in terms of the nucleation proces is indicated. It is emphasized that a number of techniques are no available for the observation of tiny aggregates of impurities in semiconductors, and the need for a consistently microscopic theo of nucleation is pointed out.

539.

10295. THE PREPARATION AND SOME PROPERTIES OF SOLI SOLUTIONS IN THE SYSTEM AlSb—GaSb.

I.I.Burdiyan and A.S.Borshchevskii.

Zh. tekh. Fiz., Vol. 28, No. 12, 2684-8 (1958). In Russian.

Three compositions, nominally AlSb.4GaSb, AlSb.GaSb, and 4AlSb.GaSb, were prepared by a zone levelling technique (graphit boat in an argon filled silica tube, zone advance rate ~ 10 mm/h 20 or more zone passes required to produce homogeneous mater The shape of the AlSb—GaSb phase diagram was determined fro heating curves. Microhardness and electrical conductivity meas ments were also made. The formation of continuous solid soluti is indicated. C.H.L.Good

539.219

6. CHANGE OF OXYGEN CONCENTRATION WITH TEMPER-
RE OF THE NICKEL AND COBALT OXIDE SOLID SOLUTIONS.
kata and K.Sakata.
ys. Soc. Japan, Vol. 13, No. 7, 675-83 (July, 1958).

The oxide solid solution MeO (= nNiO + mCoO) having a rock salt
structure is obtained; its lattice parameter varies with cation
position according to Vegard's law. The deviation from stoichio-
y in MeO thus produced was found to be less than 10^{-2}% (in
ss of oxygen). Taking this well defined divalent oxide MeO as
erence, change of oxygen concentration was studied as functions
th temperature and cation composition, with special reference
e correlation between the nature of the defects in oxides intro-
d by reaction with oxygen in air and the various physical and
ical properties which they exhibit. It turned out that the whole
tion process is divided into five distinct stages when the tem-
ture is raised from room to higher temperatures. At the first
he second stages, surface and subsurface reactions predominate.
third stage is characterized by incorporation of gaseous oxygen
the lattice. The first step of incorporation takes place without
ge of crystal structure, resulting in formation of the oxide phase
acterized by (1) having smaller unit cell dimension, (2) having
om distribution of trivalent as well as divalent cations among
attice sites and (3) having low activation energy for current
iers (~ 0.02 eV). The second step is the spinel formation,
lting from the more ordered re-arrangement of these cations.
result, the activation energy increases to ~ 0.1 eV. The fourth
e corresponds to a transitional region in which the decomposition
e spinel into the rock salt type divalent oxide MeO occurs. The
eresis is appreciable in the reaction: oxide with spinel type
cture ⇌ MeO. The reaction products at the fifth stage corre-
d to oxides with equilibrium intrinsic defects determined by the
perature and oxygen partial pressure of the atmosphere. Prod-
of each reaction stage, without exception, proved to be p-type
iconductors.

539.219 : 537.226.2

7. STUDIES ON (Ba-Pb)(Ti-Zr)O_3 SYSTEM. T.Ikeda.
hys. Soc. Japan, Vol. 14, No. 2, 168-74 (Feb., 1959).

Structural studies on the (Ba,Pb)(Ti,Zr)O_3 system were per-
ned, and the phase diagram of the whole system was determined.
e vicinity of $BaTiO_3$, low temperature phases are brought to
n temperature by adding Pb and Zr. When some Pb is substi-
d by Ba in Pb(Ti,Zr)O_3, the Curie point becomes lower, but the
photropic boundary between F_α and F_β phase shifts only gradu-
to the Ti side, and may lie nearly at the same composition with
ing temperature. The axial ratio in F_β phase decreases with
easing Ti concentration, while $90^\circ-\alpha$ in F_α decreases with in-
sing Ba and hardly depends on the Ti:Zr ratio. Some solid
tion ceramics along the morphotropic boundary with Ba 5-20%
Ti 40-50% are excellent for piezoelectric materials, and those
aining Ba ~ 30% and Ti 5-25% have large dielectric constants
low temperature coefficients.

539.219

98. TRANSFORMATION TEMPERATURES AND STRUCTURES
JRANIUM—FISSIUM ALLOYS. M.V.Nevitt and S.T.Zegler.
uclear Mater., Vol. 1, No. 1, 6-12 (April, 1959).

Solid-state transformation temperatures and resulting struc-
es are detailed for alloys of uranium with certain fission-product
nents that might remain in a spent fuel from a fast reactor
owing pyrometallurgical refining. These elements, the aggregate
hich is called "fissium" (Fs), are Zr, Nb, Mo, Tc, Ru, Rh and
The phase relations can be related to those in the dominant
Mo—Ru ternary system. The uranium gamma phase is stabilized
n to 552°C, while the beta phase is entirely suppressed at high
ium contents. Certain crystallographic data are given and the
or phases that occur in the alloys are identified.

539.219

99. STUDY OF Al—U ALLOYS. APPLICATION TO THE SOLID-
TE TRANSFORMATION $UAl_3 \rightarrow UAl_4$. R.Boucher.
uclear Mater., Vol. 1, No. 1, 13-27 (April, 1959). In French.

The coalescence of eutectic Al_4U + Al was studied micro-
pically. Two aluminium alloys 10.8 wt % and 25.8 wt % uranium
e been annealed at 600°, 500° and 400°C for times from 30 min.
00 hr. During a treatment at 600°C for 10 hr, the hardness
reases, the compound UAl_4 coalesces in nodules and rolling the
y is thus easier. Kinetics of transformation $UAl_3 \rightarrow UAl_4$ in the
d state was studied micrographically. The phase UAl_3 is re-
ed by oil-quenching from 750°C and the alloy is maintained at
600°C to obtain UAl_4. In an alloy of 40 wt % U and 60 wt % Al the time to achieve the transformation of UAl_3 in UAl_4 is short (1 hr at 600°C). In an alloy of 35 wt % U, 64.9 wt % Al and 0.1 wt % Si the time of transformation is 100 hr. In an alloy of 35 wt % U, 64.4 wt % Al and 0.6 wt % Si the phase UAl_3 is conserved even after 1000 hr at 600°C. Thus the addition of elements such as Si in relatively small proportions stabilizes UAl_3 not only at room temperature but also up to 600°C. The extent of the homogeneity domain of UAl_4 has been investigated. This domain appears much narrower then generally supposed (64.2 wt % – 66.3 wt % U).

539.219 : 536.7

ENERGIES OF TRANSFORMATION OF THE $Au_{1/2}Cu_{1/2}$ PHASES. See Abstr. 9575

539.219 : 541.18.041

DIFFUSION-LIMITED PRECIPITATION. See Abstr. 8972

539.219 : 538.2

SIMULTANEOUS DETERMINATION OF PARTICLE SIZE AND MAGNETIZATION IN THE ANGSTRÖM RANGE BY MEASUREMENT OF SUPERPARAMAGNETISM. See Abstr. 9760

539.219 : 537.226.2

A METHOD FOR THE STUDY OF PROCESSES IN IONIC CRYSTALS. See Abstr. 9582

539.22 : 541.135 : 621.317.329

10300. ANISOTROPIC FIELD PLOTTING IN THE ELECTROLYTIC TANK. D.A.Jones.
Rev. sci. Instrum., Vol. 30, No. 7, 577-8 (July, 1959).

A method of solving anisotropic problems in the electrolytic tank has been devised. The resistance of the electrolyte along the two axes is caused to be different by means of a large number of vertical insulating strips.

539.23

10301. PHOTOANODIZATION OF InSb.
J.D.Venables and R.M.Broudy.
J. appl. Phys., Vol. 30, No. 7, 1110-11 (July, 1959).

Effects of visible light ($\lambda < 5200$ A) on anodization of the (111) face of single crystal InSb are studied. In the initial stage no change with illumination is observed but beyond this the thickness of the oxide film increases with increasing intensity of illumination. By projecting an image on the face being anodized a permanent replica of the image is observed on the surface. Characteristics of photo-voltages measured are compared with those observed in Ta_2O_5 by van Geel, Pistorius, and Winkel. (Abstr. 5917 of 1958).
G.C.Williams

539.234 : 535.39

10302. INFLUENCE OF THE METHOD OF PREPARATION ON THE WAVELENGTH DEPENDENCE OF THE OPTICAL CONSTANTS OF THIN SILVER FILMS UNDER VACUUM. J.P.David.
C.R. Acad. Sci. (Paris), Vol. 248, No. 8, 1139-42 (Feb. 23, 1959).
In French.

The coefficients of reflection of a layer produced by successive evaporations are less than those of a layer of equivalent thickness prepared by one evaporation. B.T.M.Willis

539.234 : 541.135.5

10303. ELECTROLYTIC DEPOSITION OF COPPER ON A ROTATING CATHODE IN THE PRESENCE OF ULTRASOUND.
F.A.Levi.
Nuovo Cimento, Vol. 12, No. 6, 493-501 (June 16, 1959). In Italian.

Electrodeposition of copper, as a sheet a few tenths of a millimetre thick, was obtained on a rotating cathode in the presence of ultrasonics, above cavitation level. Ultrasonic waves were transmitted through the cathode, a section of which was shielded to get a control sample. Modifications of crystalline texture, due to ultrasonic irradiation were observed, among which a reduced probability of formation of bumps (radial structures), more compact deposits with a low gas content and the presence of twins. Cavitation attacks were localized and gave evidence of an action prolonged in time. Micrographic and X-ray examination gave no evidence of grain size change or preferred orientation. Microhardness (Tukon) was not changed in the average.

539.234 : 535.39

DETERMINATION OF THE OPTICAL CONSTANTS OF VERY THIN LAYERS OF LEAD IN VACUUM AND IN AIR.
See Abstr. 9506

539.234 : 537.311.31

INFLUENCE OF A SELENIUM LAYER ON THE ELECTRICAL CONDUCTIVITY OF VERY THIN GOLD LAYERS. See Abstr. 9594

539.234 : 538.2

THE MAGNETIZATION OF VERY THIN IRON FILMS. See Abstr. 9772

539.26

10304. THE INVESTIGATION OF DEFORMED CRYSTALS OF NaCl BY MEANS OF AN X-RAY MICROBEAM.
E.V.Kolontsova and I.V.Telegina.
Kristallografiya, Vol. 3, No. 1, 86-8 (1958). In Russian. English summary: PB 141065T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A. English translation in: Soviet Physics—Crystallography (New York), Vol. 3, No. 1, 80-2 (Jan.-Feb., 1958).

Crystals of NaCl which were known, from optical observations in polarized light, to have undergone deformation by slipping in certain regions were examined by a microbeam technique. The regions visible were about 150 μ across. X-ray Laue pictures were taken of regions localizable to 15 μ. Slits of width 30 μ were used and also circular diaphragms of diameter 1.5 mm, 0.15 mm and 15-20 μ. A tube with a tungsten target was used. Deformed crystals which had been marked initially with one scratch were examined. The Laue spots were drawn out but not split so that slip regions must be less than 1 μ thick. The rotation of mosaic blocks was shown to he [001], the slip plane being (110) and the slip direction $[\bar{1}10]$. The angle of rotation was about 1°. Entirely different pictures were obtained when a region where the continuous band (between crossed Nicols) was crossed by bright bands was examined. Here, the interference spots were seen to be broken up, the angle of rotation being about 2° about the same axis. Crystals which had been marked with six scratches behaved somewhat differently. The scratches were made in the [001] direction on the 100 faces of the crystals and observations (optical and X-ray) were made in the same direction.

539.26

10305. INVESTIGATION OF THE INTENSITY OF THE X-RAY DIFFRACTION LINES OF DEFORMED MOLYBDENUM.
B.I.Smirnov.
Zh. tekh. Fiz., Vol. 28, No. 12, 2693-5 (1958). In Russian.

Cylindrical specimens (10 mm diameter, 20 mm high) of polycrystalline Mo, subjected to various degrees of compressional deformation, were examined by X-ray diffraction, and the intensities of the (200) and (400) lines (I_{200} and I_{400} respectively) were measured. Deformation of 3% did not affect I_{400}, but resulted in a slight increase of I_{200}, brought about by intensive block fragmentation leading to a decrease of the primary extinction effect. With further increase of the degree of deformation both I_{200} and I_{400} decreased, the ratio $\alpha = I_{400}/I_{200}$ remaining practically constant throughout the investigated deformation range (up to 25%). The results, discussed in relation to those obtained by other workers, are taken to indicate that, if the effects of the texture and extinction are not excluded, the distortions of the third type cannot be characterized by the variation of the intensity of one set of lines or by the variation of the ratio α.
M.H.Sloboda

539.27

10306. FILMS OF PARLODION–CARBON FOR USE IN ELECTRON MICROSCOPY.
R.Dargent, L.Durrieu and J.Rzepka.
C.R. Acad. Sci. (Paris), Vol. 248, No. 13, 1962-4 (April 1, 1959). In French.

By using a backing layer of "parlodion" the usefulness of carbon support films is increased. A.E.I. Research Laboratory

539.27 : 537.533

10307. MAGNIFICATION CALIBRATION OF ELECTRON MICROSCOPES BY CRYSTAL LATTICE SPACINGS. R.Uyeda, T.Masuda, H.Tochigi, K.Ito and H.Yotsumoto.
J. Phys. Soc. Japan, Vol. 13, No. 5, 461-3 (May, 1958).

By an electron microscope Brindley, Comer, Uyeda and Zussman [Acta Cryst., Vol. 11, Pt 2, 99 (Feb., 1958)] found fringes corresponding to a superlattice of about 90 A spacing in antigorite. This paper describes trials on the use of these fringes for magnification calibration.

539

10308. ACCESSORIES FOR SPECIAL ELECTRON-DIFFRACTIO INVESTIGATIONS WITH THE ELECTRON MICROSCOPE.
H.Bethge and K.H.Brauer.
Optik, Vol. 16, No. 1, 43-9 (Jan., 1959). In German.

A specimen holder for glancing-angle diffraction is describe with independent glancing-angle and azimuthal-angle adjustments also a moving-film attachment for kinematic diffraction studies (see Abstr. 5028 of 1954). A.R.Sto

539.27 : 537

10309. APPLICATION OF AN ELECTRON-OPTICAL METHOD THE STUDY OF MICRODISTRIBUTIONS OF ELECTRIC FIELDS.
V.N.Vertsner and L.N.Malakhov.
Ootika i Spektrosk., Vol. 3, No. 6, 649-52 (Dec., 1957). In Russia

Describes the study of micro-distributions of potential on semiconductors by means of shadow electron micrographs. The method was first proposed by Marton and Lachenbruch (Abstr. 256 of 1958); it is based on the fact that electrons which form the ima of the sample interact with local electrical (or magnetic) fields a consequently their trajectories are altered. A.Tybulew

539

10310. ELECTRON MICROSCOPE STUDIES ON THE ETCHING IRRADIATED GERMANIUM. T.S.Noggle and J.O.Stiegler.
J. appl. Phys., Vol. 30, No. 8, 1279-88 (Aug., 1959).

Electron microscope and electron diffraction studies on the surface of CP-4 etched germanium specimens have shown that the changes in etching behaviour induced by fast neutron irradiation occur as a result of a gross change in chemical behaviour and can not be due to local variations in the etching rate in the vicinity of the structural defects introduced by the irradiation. Observations on network structures which are produced under certain condition of etching indicate that these arise as a result of mechanical prep aration of the surfaces or from changes in the etching process and are apparently unrelated to any prior substructure in the material

ELASTICITY . STRENGTH . RHEOLOGY

539

10311. INTERNAL FRICTION AND PLASTIC DEFORMATION O OVERSTRESSED MICRO-REGIONS OF A SOLID.
R.I.Garber and T.T.Mogil'nikova.
Dokl. Akad. Nauk SSSR, Vol. 118, No. 3, 479-82 (Jan. 21, 1958). In Russian. English translation in: Soviet Physics — "Doklady" (New York), Vol. 3, No. 1, 157-60 (Jan.-Feb., 1958).

In torsional oscillations of a tube of Pb the logarithmic decre ment is independent of amplitude and of constant additional stress imposed by applying pressure inside the tube. But the internal friction is increased by an amount depending on the applied press and on the rate of increase of applied pressure at rates exceeding about 0.04 atm/sec. The results are explained in terms of the creation during elastic deformation of inhomogeneous micro-reg where plastic deformation occurs. J.G.Oldr

539.

10312. THERMAL SHOCK IN AN ELASTIC BODY WITH A SPHERICAL CAVITY. E.Sternberg and J.G.Chakravorty.
Quart. appl. Math., Vol. 17, No. 2, 205-18 (July, 1959).

This investigation aims at the dynamic thermoelastic respons of an infinite medium with a spherical cavity to a sudden uniform change in the temperature of its internal boundary. By means of the Laplace transform, a closed solution to this problem—exact within classical elastokinetics—is obtained in terms of error functions of real and complex arguments. The ensuing temperatu stresses are compared with the corresponding quasi-static result

539.319 : 539

10313. THE DETERMINATION OF RESIDUAL STRESSES WITH THE HELP OF X-RAYS. I. V.A.Ageev.
Zh. tekh. Fiz., Vol. 28, No. 11, 2514-19 (1958). In Russian.

A rigorous formula is given for the shape of a Debye ring obtained from a polycrystalline surface in a state of plane stress, for arbitrary Bragg angle and direction of incident beam. Some possible shapes are shown diagramatically. The usual assumptio that the Bragg angle is close to 90° is dropped, and methods are given for determining the stress components when the lattice con stant is known or unknown. A suitable choice of Bragg angle for methods would be ~70°. K.F.Hu

539.319 : 539.26

4 THE DETERMINATION OF RESIDUAL STRESSES WITH LP OF X-RAYS. II. V.A.Ageev.

1. Fiz., Vol. 28, No. 11, 2520-6 (1958). In Russian.

Pt I, see preceding abstract. It is argued that the average
component normal to the surface in a surface layer is not
rily zero as is usually assumed in the theory of stress
ination by X-rays. A rigorous formula is given for the
f the distorted Debye ring obtained from a polycrystalline
with three arbitrary oriented unequal principal components
s, for arbitrary Bragg angle and direction of incident beam.
s are given for determining the three principal components of
and their orientations. An experimental technique for
ely measuring the distortions of the Debye ring is described.
K.F.Hulme

539.319 : 539.26

ON THE MICROSTRESSES ARISING IN POLYCRYSTALLINE IENS DURING PLASTIC DEFORMATION. D.M.Vasil'ev.

h. Fiz., Vol. 28, No. 11, 2527-42 (1958). In Russian.

e Debye line-widths and displacements in X-ray photographs
culated assuming that the microstresses in the material
preferential direction — as might be the case in a metal
as previously undergone uniaxial plastic deformation.
mental results obtained on iron and steel specimens support
a of oriented microstresses — the microstresses becoming
trongly oriented with increasing deformation. The existence
d" and "soft" regions during plastic deformation is suggested
ection with oriented microstresses. It is claimed that a
d knowledge may be obtained of the stress field in a material
its plastic deformation. K.F.Hulme

539.32

A NEW METHOD OF DETERMINING POISSON'S RATIO TALS AND ALLOYS. G.Vidal and F.Girard.

cad. Sci. (Paris), Vol. 248, No. 9, 1286-9 (March 2, 1959).
ch.

o cylindrical specimens, both 30 mm long, one 6 mm and
er 30 mm in diameter, are shock excited into vibration and
espective natural frequencies N_0 and N_1 are determined. The
$= N_1/N_0$ is substituted into the equation:

$$m = 0.0622 + 2.696(1 - z) + 2.74(1 - z)^2,$$

hich Poisson's ratio, m, is determined. It is claimed that
uation holds for the range of m from 0.20 to 0.40 and covers
f the metals. The method has given reasonable values for
ens of most of the common pure metals. The equation is
d theoretically. A.C.Whiffin

539.32

ON THE PROBLEM OF THE DETERMINATION OF THE ICIENTS OF COMPRESSIBILITY AND THE ELASTIC BULK LUS OF A SOLID. K.P.Rodionov.

etallov i Metallovedenie, Vol. 6, No. 5, 786-93 (1958).
sian.

e "true" compressibility κ and bulk modulus K are defined

$$\kappa = -\frac{1}{v}\left(\frac{\partial v}{\partial p}\right)_T$$

$$K = -v\left(\frac{\partial p}{\partial v}\right)_T$$

s κ and K are usually defined w.r.t. the initial volume i.e.
$_0\left(\frac{\partial v}{\partial p}\right)_T$. Similarly for K_1. Expressions are derived for
etc.valid for p up to 10^5 kg/cm^2. As examples of the use of
alysis further formulae are derived for change of internal
and of Debye characteristic temperature of a solid subjected
pressure. A.F.Brown

539.32

ON THE TEMPERATURE DEPENDENCE OF YIELD S FOR ALUMINIUM. W.D.Sylwestrowicz and D.F.Gibbons.

Mag. (Eighth Ser.), Vol. 3, 1326-7 (Nov., 1958).

Because the yield stress of Al single crystals and poly-
lline material has been found temperature dependent, the
n between yield stress, elastic modulus and temperature has
nvestigated. The ratio yield-stress/modulus was found temp-
e dependent for polycrystalline Al from liquid nitrogen to
l temperatures, while, for single crystals, it was strongly
ature dependent at low temperatures. The elastic moduli were then replaced by those measured in single crystals in the plane and direction of primary slip, the modulus being computed from the isothermal elastic moduli. The ratios of the moduli at room temperature and liquid nitrogen were found to be 1.11 and were thus smaller than would be needed to make the ratio yield-stress/elastic-modulus independent of temperature, because the ratio of the yield stresses is about 0.74 at these two temperatures.
A.C.Whiffin

539.32

10319. THE INTERNAL FRICTION OF BARIUM TITANATE CERAMICS. T.Ikeda.

J. Phys. Soc. Japan, Vol. 13, No. 8, 809-18 (Aug., 1958).

Studied under various conditions. It depends on temperature, biasing field and vibration amplitude, but is nearly independent of frequency and porosity. It is concluded that its main part is not caused by the ceramic and domain structures but is the property of the single domain crystal, which is of intrinsically dielectric origin, acting through piezoelectric coupling.

539.32

10320. SECOND LOW-TEMPERATURE PEAK IN THE INTERNAL FRICTION OF ALUMINUM. E.Lax and D.H.Filson.

Phys. Rev., Vol. 114, No. 5, 1273 (June 1, 1959).

A peak in the internal friction due to dislocations in aluminium was found well below the temperature of the usual Bordoni peak. Ultrasonic absorption measurements were made from 25 kc/s to above 1 Mc/s, yielding a relaxation peak that varied with frequency over a temperature range of 21° to 31°K. The activation energy of this peak was found to be 0.024 eV.

539.32

10321. CONSTRUCTION OF A SENSITIVE TEMPERATURE CONTROLLED TORSIONAL PENDULUM.

E.W.Dickson and N.Thorley.

Proc. Univ. Durham Phil. Soc. A, Vol. 13, No. 11, 98-107 (1959).

The vertical tubular furnace and its temperature control system, and the housing and constructional details of the pendulum are fully described and illustrated. The suspensions consisted of cold-drawn super-pure aluminium wire 0.045 cm in diameter. The frequency of oscillation of the pendulum was 0.3 c/s and the torsional deflection of the inertia arm was measured by means of an optical lever. Some preliminary experimental results of measurements of the modulus of rigidity and internal friction of the wire specimens are given and discussed. Both the rigidity modulus and internal friction changed with time at constant temperature. For the timing mechanism of the pendulum see Abstr. 3750 (1958). S.Weintroub

539.371

10322. EXPERIMENTAL INVESTIGATION OF BULGING OF SHELLS UNDER DYNAMIC STRESSES.

A.S.Vol'mir and V.E.Mineev.

Dokl. Akad. Nauk SSSR, Vol. 125, No. 5, 1002-3 (April 11, 1959). In Russian.

An instrument is described for the investigation of bulging of cylindrical metallic tubes under variable water pressure; it is capable of applying pressures from 5 to 50 atm. The results of some experiments (e.g. on the critical pressures, speed and time characteristics of bulging) are described. J.K.Skwirzynski

539.373

10323. OBSERVATION OF THERMALLY INDUCED GLIDE IN GERMANIUM. R.L.Cummerow.

J. appl. Phys., Vol. 30, No. 6, 946 (June, 1959).

Heating the specimen caused glide bands to extend across an elastically deformed region, producing a more uniform distribution of plastic deformation as a first stage in the recovery process.
I.Cooke

539.373

10324. THE INFLUENCE OF ARSENIC CONTENT IN COPPER CRYSTALS ON EASY GLIDE AT −183°C. K.Schröder.

Proc. Phys. Soc., Vol. 73, Pt 4, 674-6 (April, 1959).

The work was performed to extend and confirm other recent investigations showing that the addition to a pure metal of a soluble impurity increases the range of easy glide in tensile tests on single crystals. Spectroscopically pure copper crystals were prepared 2 mm in dia. by 30-40 mm long and containing arsenic contents ranging from zero up to 1.72%. All specimens were immersed in liquid O_2 during testing and the strain rate was chosen to give an initial rate of shear strain of 4×10^{-5} sec^{-1}. The extent of easy glide increased with arsenic content up to 0.084% and then decreased again. At 1.74% As, the rate of hardening was so great than only a small strain could be given and it was not possible to decide whether easy glide was present. The critical shear stress was raised by the addition of arsenic. For most crystals, the easy glide ended at about twice the critical shear stress. It is suggested that the motion of dislocations on the primary system is unimpeded by locking, but, once the yield stress is exceeded, secondary slip is hindered by the locking of the sources on these systems. A.C.Whiffin

539.374

10325. THE CRYSTAL DEFORMABILITY CRITERION AND ADSORPTION EFFECTS. E.D.Shchukin.

Dokl. Akad. Nauk SSSR, Vol. 118, No. 6, 1105-8 (Feb. 21, 1958). In Russian. English translation in: Soviet Physics—"Doklady" (New York), Vol. 3, No. 1, 143-6 (Jan.-Feb., 1958).

A relation between adsorption effects and the dislocation theory of plastic flow and brittle fracture is established. The author develops the Mott model of brittle fracture by dislocation pile-up at an obstacle in a slip plane. Criteria are derived for the occurrence of plastic flow and brittle fracture as functions of strain rate and temperature. The effects of impurities are investigated in terms of the change in the surface free energy. The changes in yield point due to variations in surface free energy and temperature are discussed. M.G.Priestley

539.374 : 537.29

10326. APPLIED VOLTAGE AND THE PLASTIC PROPERTIES OF "BRITTLE" ROCK SALT. E.S.Machlin.

J. appl. Phys., Vol. 30, No. 7, 1109-10 (July, 1959).

A decrease in yield stress and an increase in ductility occur with the application of voltage across specimens of embrittled single crystals of rock salt. Results for studies of flow stress in compression are not reproducible. No measured effects are observed in ductile specimens. G.C.Williams

539.374

10327. ON THE FORMATION OF SMALL GUINIER—PRESTON (1) AGGREGATES DURING THE PLASTIC DEFORMATION OF AN Al—Cu ALLOY. K.Matsuura, Y.Hamaguchi and S.Koda.

J. Phys. Soc. Japan, Vol. 12, No. 12, 1424 (Dec., 1957).

Specific resistivity at room temperature was found to increase rapidly at small plastic strains in polycrystalline wires which had been heat-treated at 530°C and air quenched to obtain a state of supersaturated solid solution. The effect was absent in furnace-cooled specimens and is attributed to the formation of Guinier—Preston aggregates. Similar experiments at −196°C confirm that the formation of aggregates is suppressed at low temperature and that point imperfections then give rise to an increase in resistivity. J.G.Oldroyd

539.374

10328. THE PLASTIC DEFORMATION OF URANIUM OXIDES ABOVE 800°C. R.Scott, A.R.Hall and J.Williams.

J. nuclear Mater., Vol. 1, No. 1, 39-48 (April, 1959).

Sintered uranium oxide of composition $UO_{2.06}$ or $UO_{2.16}$ and density exceeding 95% theoretical can be deformed plastically at about 800°C, but $UO_{2.00}$ becomes plastic only above ≃ 1600°C. The bend-creep characteristics of $UO_{(2+x)}$ are similar to those of metals inasmuch as they obey the expression

$$\dot{\epsilon} = A \sinh(\sigma/\sigma_0) \exp(Q/RT),$$

where $\dot{\epsilon}$ is the strain-rate, σ the stress and T the absolute temperature. A, σ_0 and Q are material constants. The activation energy of flow, Q, varies with the oxygen/uranium ratio, being about 65 kcal for $UO_{2.16}$, 72 kcal for $UO_{2.06}$ and ≥ 95 kcal for $UO_{2.00}$. This latter value for $UO_{2.00}$ is comparable with the activation energy of 95–120 kcal experimentally determined for the diffusion of uranium in $UO_{2.0}$.

539,374

10329. FOLDING OF A LAYERED VISCOELASTIC MEDIUM DERIVED FROM AN EXACT STABILITY THEORY OF A CONTINUUM UNDER INITIAL STRESS. M.A.Biot.

Quart. appl. Math., Vol. 17, No. 2, 185-204 (July, 1959).

A layer of viscoelastic material embedded in an infinite medium also viscoelastic tends to fold through instability when the system is compressed in a direction parallel with the layer. This phenomenon, which was treated previously by the author using an approximate plate theory, is analysed here by using an exact theory for the deformation of a continuum under prestress. The effect of the compressive prestress in the embedding medium is taken into account, and it is found that although it is not always negligible, it tends to be very small under conditions where the instability of the layer is strong. The same conclusion holds for the error involved in the u of a plate theory for the layer instead of the exact equations for a prestressed continuum. In the course of the analysis we have als treated the problem of a semi-infinite viscoelastic half-space subject to a uniform internal compression parallel with the boundary and a surface load normal to this boundary. The compressive loa produces an increase of the surface deflection under the normal lo This effect appears through an amplification factor which is evaluated numerically for the particular example of an elastic body. It is shown that under certain conditions the free surface of the compressed semi-infinite medium may become unstable and will tend wrinkle. This is suggested as a probable explanation for the wrinkles which appear on the surface of a body subjected to a plastic compression.

539.4.016 : 537.311

FORMATION OF ZONES IN ALUMINIUM ALLOYS. See Abst See Abstr. 9613

539.4.016 : 538.

NUCLEAR MAGNETIC RESONANCE IN ROLLED COPPER SHEET. See Abstr. 9845

539.4

10330. STATISTICAL ASPECT IN ACCELERATING CREEP AN CREEP FRACTURE OF O.F.H.C. COPPER.

T.Yokobori and H.Ohara.

J. Phys. Soc. Japan, Vol. 13, No. 3, 305-12 (March, 1958).

A large number of creep rupture tests on O.F.H.C. copper wi were carried out at stress levels of 24.0-25.0 kg/mm^2 and temper atures of 8-40°C. The F-test was made for the differences in variance between time for initiation of accelerating creep and tim for rupture measured from the initiation of accelerating creep, an the regression analysis between these times was carried out. The scatter observed for these times appears to be an inherent charac teristic of the material itself associated with a Markoff process — dynamic statistical process — as a rate process.

539.

10331. INFLUENCE OF ORDER—DISORDER ON CREEP OF A SUPERLATTICE ALLOY. T.Suzuki and M.Yamamoto.

J. Phys. Soc. Japan, Vol. 14, No. 4, 463-72 (April, 1959).

A study has been made of the influence of order—disorder on the creep of a superlattice alloy Ni_3Fe. The results obtained str ly support the dislocation-climb mechanism. The activation ener for creep, independent of applied stress, slightly increases with t degree of order: 45.8 kcal/mol for disordered and 47.5 ± 2.0 kca mol for ordered phases. A discontinuity occurs at the critical te perature, i.e., 505°C in the curves of creep rate v. the reciprocal temperature. A remarkable acceleration of creep has been obser in the disordered alloys below T_C, which were obtained by quenc from 800°C, as compared with the rates expected from the values above T_C. A semi-quantitative theory has been proposed for suc configurational acceleration of creep in terms of order—disorder kinetics and dislocation processes in the super-lattice alloy of A f.c.c. type. In ordered alloys, the vacancy diffusion introducing t dislocation-climb is thought to be anisotropic with regard to the orientation of slip bands. This will result a significant differenc the stress dependence of creep rates in ordered phases from the in disordered phases as observed here.

53

10332. FLOW PROPERTIES OF LINEAR POLYMERS. H.J.Kar

Industr. engng Chem., Vol. 51, No. 7, 851-3 (July, 1959).

Discusses methods of measuring rheological properties and c characterizing the flow. Examples are given of the flow of polystyrene, rubber-modified polystyrene, styrene copolymers, and h and low pressure polyethylene. These are examined in terms of molecular weight, molecular weight distribution, molecular orien tation and branching. Degradation studies are also mentioned. Evaluation of rheological data is considered.

539.5 : 53

10333. FLOW MECHANISM OF THIXOTROPIC SUBSTANCES.

S.J.Hahn, T.Ree and H.Eyring.

Industr. engng Chem., Vol. 51, No. 7, 856-7 (July, 1959).

It is assumed that a thixotropic system comprises a three-dimensional network of entangled molecules (non-Newtonian beha iour), in which coiled disentangled (Newtonian) and solvent molec are enclosed. Under stress, the entangled molecules transform t isentangled molecules. The Ree–Eyring flow equation is applied to his model, and two flow equations are derived which quantitatively escribe the hysteresis loops in the shear rate v. shear stress curve.

539.52 : 537.312.8

CONTROLLING THE MECHANICAL PROPERTIES OF ISMUTH BY MEANS OF SMALL ADDITIONS OF NICKEL.
ee Abstr. 9665

539.531 : 536.21

0334. REGARDING CORRELATION BETWEEN HARDNESS AND HERMAL CONDUCTIVITY OF NONMETALLIC CRYSTALS.
.P.Zhuze and T.A.Kontorova.
h. tekh. Fiz., Vol. 28, No. 8, 1727-33 (1958). In Russian.
nglish translation in: Soviet Physics—Technical Physics (New ork), Vol. 3, No. 8, 1593-8 (Aug., 1958).

A correlation between the microhardness and thermal conductvity of various materials with a covalent diamond type structure is eported: as the microhardness decreases the thermal conductivity lso decreases. Furthermore the microhardness decreases reguarly with increasing atomic spacing. A similar correlation is also ound for the alkali metal halides where the chemical bonding is ainly ionic. By assuming an interatomic potential of the form $\cong -Ar^{-m}+Br^{-m}$ the authors are able to explain the abnormal correation and the variation with atomic spacing. R.Bullough

539.56 : 621.318.132

0335. A CRITICAL RANGE OF BRITTLENESS OF ELECTRICAL NGINEERING STEELS. N.I.Lapkin, G.N.Shubin and S.I.Doroshek.
iz. Metallov i Metallovedenie, Vol. 4, No. 3, 478-82 (1957).
n Russian.

Brittleness of silicon steels increases sharply at 2-4% of Si ut it can be reduced by heating to 100-250°C.

539.56 : 548.24

10336. TWIN-FORMATION AND COLD-BRITTLENESS.
N.Davidenkov and T.N.Chuchman.
Zh. tekh. Fiz., Vol. 28, No. 11, 2502-13 (1958). In Russian.

Impact tests on Fe showed that the transition temperature to rittle fracture was close to the temperature below which abundant eformation twinning occurred; also prior deformation twinning ncreased the transition temperature. However, high-speed impact n notched Ta specimens failed to produce brittle fracture even at .2°K, although abundant deformation twins were produced (several nteresting micrographs are shown, but no X-ray confirmation of he presence of twins was made). It is concluded that twin formation s not a sufficient condition for brittle fracture, although it may ssist; twin formation may not even be necessary. K.F.Hulme

539.58

10337. NOTE ON THE ARTICLE BY HEWITT AND ANTHONY: "MEASUREMENT OF THE ISOTHERMAL VOLUME DILATION ACCOMPANYING THE UNILATERAL EXTENSION OF RUBBER".
T.N.Khasanovich.
J. appl. Phys., Vol. 30, No. 6, 948-9 (June, 1959).

Some direct deductions from the statistical theory of rubber elasticity regarding the compressibility anisotropy of rubber in a stretched state lead to a formula for volume changes agreeing less well with experiment than that of Hewitt and Anthony (Abstr. 5198 of 1959), which was based on Gee's formula for dilation.

J.G.Oldroyd

539.61

10338. NEW DEVICE FOR MEASURING THE ADHESION BETWEEN METALLIC RODS. P.Andreatch and O.L.Anderson.
Rev. sci. Instrum., Vol. 30, No. 6, 498-9 (June, 1959).

A modified lathe is used to measure the adhesion between machined metal surfaces. Two prepared rods are pressed together under a known load in the lathe and one is twisted, causing intense tangential scrubbing and seizure; and the force required to break the welded asperities is then measured. J.G.Oldroyd

539.63 : 531.577

10339. PITS IN METALS CAUSED BY COLLISION WITH LIQUID DROPS AND SOFT METAL SPHERES. O.G.Engel.
J. Res. Nat. Bur. Stand., Vol. 62, No. 6, 229-46 (June, 1959).

An equation is developed to give pit depth as a function of collision velocity for pits formed in soft to medium-hard metal plates as a result of collision with liquid drops. The rear face of the target plate must be a free surface. The plate thickness must not be less than 1.5 to 2.0 times the drop diameter nor greater than 4 to 5 times the drop diameter. It is shown that, under the same conditions on the target plate, the equation is also applicable to pits formed in soft to medium hard metal plates as a result of collision with spheres of the same metal that flow radially as a result of collision. Pit-depth —velocity data obtained by other workers were used to test the equation. Metals used as targets were copper, 1100-0 aluminium, 2024-0 aluminium, lead, steel, soft iron and zinc. Mercury was used as the drop liquid against copper, aluminium, lead, and steel. Water was used as the drop liquid against copper, aluminium, and lead. Spheres of copper, aluminium, lead, soft iron, and zinc were used against targets of the same materials, respectively. The equation can be used to calculate the dynamic compressive yield strength of soft to medium-hard metals.

539.89

10340. SOME REMARKS ON EXPERIMENTS IN THE DENSE STATE. A.Michels.
Nuovo Cimento Suppl., Vol. 9, No. 1, 152-62 (1958).

Discusses the design of high-pressure experiments, particularly the precision needed to obtain various sorts of information from the equation of state. Discusses also certain anomalies in the high-pressure heat conductivity of argon, and the interpretation of the speed of sound in the critical region. J.Hawgood

PHYSICAL CHEMISTRY

PHASE EQUILIBRIUM

CHEMICAL REACTIONS

541.122.3

10341. VALIDITY AND CONSEQUENCES OF SCHREINEMAKERS' HEOREM ON TERNARY DISTILLATION LINES.
.E.Korvezee and J.L.Meijering.
J. chem. Phys., Vol. 31, No. 2, 308-13 (Aug., 1959).

The tangential behaviour of distillation lines in a ternary ixture, as brought forward by Schreinemakers more than half a entury ago, was denied some time ago by Redlich and Kister Abstr. 689 of 1951). The authors now give another proof of the orrectness of Schreinemakers' theorem. Parameters Q_0 are efined governing the course of the distillation lines in each corner f the composition triangle. The Q_0 values are, in principle, erivable from accurate binary boiling point curves. The occurrence of distillation lines with one or two points of inflection in a ternary system without complications from azeotropes or demixing is discussed at some length. (See also following abstract).

541.122.3

10342. PHYSICALLY MEANINGFUL CONCEPTS. O.Redlich.
J. chem. Phys., Vol. 31, No. 2, 314 (Aug., 1959).

A statement on distillation lines, made by Schreinemakers and repeated by Korvezee and Meijering (see preceding abstract), lacks any physical meaning.

541.124

10343. ON THE EXISTENCE OF OSCILLATING CHEMICAL REACTIONS. T.A.Bak.
Bull. Acad. Roy. Belgique Cl. Sci., Vol. 45, No. 2, 116-29 (1959).

The possibility of oscillating chemical reactions is discussed, and it is shown that, in systems where only first-order reactions occur, oscillations around equilibrium states or stationary states are not possible. For systems described by non-linear differential equations, however, it is known that oscillations around stationary states can occur, since the equations of Volterra can be interpreted as describing a set of chemical reactions. The necessary and sufficient conditions for the occurrence of oscillations in a chemical system are derived as inequalities among the rate constants, using the criterion of Sturm. It is pointed out that none of the chemical reactions alleged to show oscillatory behaviour has been thoroughly investigated experimentally.

541.126 : 534.222.2

INTERACTION OF SHOCK WAVES WITH A FLAME FRONT. See Abstr. 9324

541.127

10344. ON THE DIFFUSION THEORY OF THE KINETICS OF BIMOLECULAR REACTIONS IN SOLUTION.
R.Ya.Sveshnikov and L.A.Kuznetzova.
Dokl. Akad. Nauk SSSR, Vol. 121, No. 6, 1045-7 (Aug. 21, 1958).
In Russian.

Discusses the way in which the decay constant of the phosphorescence of acridine orange when involved in chemical reactions depends upon the viscosity of the solution. J.M.Hough

541.127

10345. LIMITATIONS OF THE REFLECTED SHOCK TECHNIQUE FOR STUDYING FAST CHEMICAL REACTIONS. G.B Skinner.
J.chem. Phys., Vol. 31, No. 1, 268-9 (July, 1959).

Measurements of incident and reflected shock pressures in argon as a function of incident shock velocities were made for comparison with values calculated from ideal equations. Smaller discrepancies than those of Strehlow and Cohen (Abstr. 4087 of 1959) were observed. G.I.W.Llewelyn

541.127

10346. KINETICS AND MECHANISM OF ETHYLENE OXIDE DECOMPOSITION AT HIGH TEMPERATURES.
L.Crocco, I.Glassman and I.E.Smith.
J. chem. Phys., Vol. 31, No. 2, 506-10 (Aug., 1959).

In a new flow reactor designed for the study of reaction kinetics at high temperatures, the rates of decomposition of ethylene oxide were measured to temperatures approaching its adiabatic decomposition point (~ 1200°K). This device is unique in that it follows the reaction process, not by a freezing technique usually employed in flow systems, but by tracing the temperature history of the reaction. The ethylene oxide decomposition study showed that the kinetics followed an over-all first-order mechanism and the over-all activation energy was 42 ± 2 kcal/mole. The results were found to be independent of the amount of fuel injected, the velocity of the inert carrier gas, and the inert gas itself. A free radical decomposition mechanism consistent with the experimental results is postulated.

ELECTROCHEMISTRY

541.133

10347. THE CONDUCTANCE OF CONCENTRATED AQUEOUS SOLUTIONS OF POTASSIUM IODIDE AT 25° AND OF POTASSIUM AND SODIUM CHLORIDES AT 50°. J.F.Chambers.
J. phys. Chem., Vol. 62, No. 9, 1136-8 (Sept., 1958).

The results of experimental measurements are given, and a table of the equivalent conductances of the three salts at rounded concentration values compiled: for KI up to 5.5, for KCl up to 4.0, and for NaCl up to 5.0 molar. W.Good

541.135

10348. TRANSPORT PROCESSES IN ELECTROLYTE SOLUTIONS.
R.J.Podolsky.
J. Amer. Chem. Soc., Vol. 80, No. 17, 4442-51 (Sept. 5, 1958).

A lattice model that takes ion—solvent interaction into account is developed for aqueous electrolyte solutions. Application of absolute reaction rate theory to this model quantitatively correlates (a) the influence of an ion on the fluidity of a solution, (b) the influence of an ion on the self diffusion of the solvent, and (c) the limiting mobility of an ion. Also, the dependence of the limiting ionic mobility on temperature and on pressure is considered. Data for thirty-eight ionic species, with crystal radius less than or equal to 4 A, are used to test the theory.

541.135 : 539.22 : 621.317.729.

ANISOTROPIC FIELD PLOTTING IN THE ELECTROLYTIC TANK. See Abstr. 10300

541.135.5

10349. THEORY OF STEADY STATE LIMITING CURRENT AT STATIONARY WIRE ELECTRODES. N.Ibl.
Electrochimica Acta, Vol. 1, No. 1, 3-17 (April, 1959).

The steady state limiting current at a vertical wire electrode under conditions of natural convection is calculated from the boundary layer theory of convective mass transfer. The integral method of von Kármán is applied to the case of a curved surface wit cylindrical symmetry. The conditions under which substantial departures from the flat electrode behaviour occur are discussed quantitatively. The results are given in dimensionless form so that the variations of the seven main variables involved in the problem can be represented with the help of two variable dimensionless groups only. The generalized correlation thus obtained allows a complete calculation of the limiting current from general properties of the system considered (diffusion coefficient, viscosity and concentration of solution, densification coefficient, height and radius of electrode). The case of a mixture of electrolytes (including especially the case of an excess of indifferent electrolyte usually present in polarographic practice) has also been treated. The calculated values of the limiting current are compared with the experimental results of various authors.

541.135.5 : 539.23

ELECTROLYTIC DEPOSITION OF COPPER ON A ROTATING CATHODE IN THE PRESENCE OF ULTRASOUND. See Abstr. 10303

PHOTOCHEMISTRY
RADIATION CHEMISTRY

541.14

10350. PHOTOLYSIS OF OXYGEN IN SOLUTION IN LIQUID NITROGEN AND IN LIQUID CARBON MONOXIDE AT 1849 A.
J.R.McNesby.
J. chem. Phys., Vol. 31, No. 1, 283-4 (July, 1959).

In photolysis at liquid nitrogen temperature, with a SC-2537 low-pressure arc with a thin quartz envelope to intensity the 1849 A radiation, of solutions of oxygen in nitrogen the main product was ozone, with 16% of nitrous oxide, not originating from reaction of ozone with oxides of nitrogen or nitrogen. Photolysis of oxygen dissolved in liquid CO under the same conditions produced CO_2 + 10% O. The mechanism of the reactions is discussed. R.C.Murray

DISPERSIONS . COLLOIDS . ADSORPTION

541.182.5 : 539.21

10351. GEL FORMATION OF AQUEOUS SOLUTION OF POLYVINYL ALCOHOL IRRADIATED BY GAMMA RAYS FROM COBALT-60. A.Danno.
J. Phys. Soc. Japan, Vol. 13, No. 7, 722-7 (July, 1958).

Experiments were carried out on the irradiation of aqueous solutions of polyvinyl alcohol by gamma-rays. For sufficient dose of radiation, the polymer molecules in the solution interlinked with each other and formed an insoluble gel. The change in degree of polymerization of the polymer with the absorbed dose, and the minimum dose R_g, required to produce a gel, were measured as a function of concentration of polyvinyl alcohol. In dilute solutions below the critical concentration, gel formation did not occur even for prolonged irradiation. These phenomena are discussed.

541.18

10352. ADSORPTION OF WATER VAPOUR ON GLASS AND OTHER MATERIALS IN VACUUM. H.Okamoto and Y.Tuzi.
J. Phys. Soc. Japan, Vol. 13, No. 6, 649-55 (June, 1958).

The adsorption of water vapour on lead borosilicate glass, sod lime glass, copper, nickel and alumina ceramic in high vacuum was studied by the time lag method of molecular flow originated by Barrer. The amount of adsorption at 273°-403°K and $2 \times 10^{-[illegible]}$ mm was found to be less than 1% of a monolayer. It is suggested that the adsorption of water vapour in this pressure region will not be a simple physical adsorption.

541.183

10353. ADSORPTION OF WATER VAPOUR ON LEAD BOROSILICATE GLASS IN VACUUM. Y.Tuzi and H.Okamoto.
J. Phys. Soc. Japan, Vol. 13, No. 8, 960-5 (Aug., 1958).

Studied in the pressure region 10^{-5}-10^{-6} mm Hg, using a modified flashing technique. The adsorption is composed of at least two parts: the physical and the activated adsorption. The amount of the physical adsorption at 1×10^{-6} mm Hg, 0-50°C, was 0.1 – 0.4% of a monolayer, and the heat of adsorption was 11 kcal/mole. The activation energy of adsorption of the activated adsorption was about 9 kcal/mole, and the activation energy of desorption was 13-40 kcal/mole.

541.183 : 538.27

NUCLEAR MAGNETIC RESONANCE STUDY OF WATER ADSORBED ON SILICA GEL. See Abstr. 9837

541.183 : 548.5

EFFECT OF ADSORPTION ON CRYSTAL FACE DEVELOPMENT. See Abstr. 8997

CHEMICAL ANALYSIS

545.82 : 535.37

10354. NATURE OF FLUORESCENCE OF URANIUM IN FUSED SODIUM FLUORIDE. H.le Roux.
Nature (London), Vol. 183, 1180-1 (April 25, 1959).

Examination of the process for determining U by fusion with NaF and measurement of the fluorescence of the product shows that the presence of oxygen is necessary in the fusion. Fusion in an atmosphere of argon reduces the resulting fluorescence or, if NaHF$_2$ is used instead of NaF, may prevent its appearance. Absorption spectra of the argon-fused products have a maximum at 2900 A differing from the absorption of U^{4+} or U^{6+}. The emission spectra of the fusion products vary, especially in the violet region. It is concluded that the fluorescent product does not resemble any of the parent compounds. S.T.Henderson

CRYSTALLOGRAPHY

548.24 : 539.56

TWIN-FORMATION AND COLD-BRITTLENESS. See Abstr. 10336

548.4 : 537.533

10355. THE SEPARATION OF GASES IN THE CLEAVAGE OF CRYSTALLINE QUARTZ. V.V.Karasev.
Zh. eksper. teor. Fiz., Vol. 34, No. 5, 1330-1 (1958). In Russian. English summary: PB 141052T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

An apparatus designed to study exo-electron emission and gas pressure changes due to crystal cleavage is described. No electron emission nor pressure change was observed during cleavage of glass or fused quartz; but when crystalline quartz was cleaved the pressure rose from about 10^{-7} mm Hg to about 10^{-5} – 10^{-4} mm Hg, and electron emission was observed. A rise in pressure has been observed due to cleavage of mica and during the stripping of high-polymer films from glass. C.H.B.Mee

548.5 : 535.825

10356. AN APPARATUS FOR THE STUDY OF CRYSTAL GROWTH UNDER THE MICROSCOPE. T.G.Petrov.
Kristallografiya, Vol. 2, No. 6, 777 (1957). In Russian. English translation in: Soviet Physics—Crystallography (New York), Vol. 2, No. 6, 761-4 (Nov.-Dec., 1957).

An apparatus has been developed which is a combination of a specially constructed thermostat with three interchangeable vessels designed for different types of crystallization. Measurement of the velocity of growth of different crystal faces by means of a cine camera or a micrometer ocular, as well as of the temperature of saturation of the solution in the vessel, can be made with this apparatus, and later the crystal can be studied on a goniometer, or by means of X-rays, etc.

548.5

10357. GROWTH OF LARGE DIAMETER SILICON AND GERMANIUM CRYSTALS BY THE TEAL—LITTLE METHOD. W.R.Runyan.
Rev. sci. Instrum., Vol. 30, No. 7, 535-40 (July, 1959).

The equipment and techniques used to grow 6 in. diam. silicon and germanium crystals are described, and the effect of spin, radiation, and mode of heating on crystal growth from a melt is discussed.

548.5 : 537.311.33

10358. PREPARATION OF INDIUM ARSENIDE. R.H.Harada and A.J.Strauss.
J. appl. Phys., Vol. 30, No. 1, 121 (Jan., 1959).

The compound was made from vacuum-baked indium and arsenic obtained from doubly-distilled arsenic trichloride reduced with hydrogen. After zone-refining, the free electron concentration was less than 2×10^{16} cm^{-3}, and the Hall mobility 60 000 cm^2/(V sec) at 77° K and 25 000 cm^2/(V sec) at room temperature. Large single crystals were grown using a horizontal Bridgman technique. C.Hilsum

548.5 : 539.2

GROWTH AND DEFECTS OF SEMICONDUCTOR CRYSTALS. See Abstr. 10218

548.5

10359. ZONE MELTING OF BORON. E.S.Greiner.
J. appl. Phys., Vol. 30, No. 4, 598-9 (April, 1959).

Gives details of the techniques used in the zone melting of B, using B$_2$O$_3$ as a binder. The final zone-melted B is coarsely polycrystalline and could probably be converted to a single crystal by repeated zone-melting or the use of a seed. J.Thewlis

548.5

10360. ON THE GROWTH AND PROPERTIES OF ELECTROLYTIC WHISKERS. P.B.Price, D.A.Vermilyea and M.B.Webb.
Acta metallurgica, Vol. 6, No. 8, 524-31 (Aug., 1958).

Under certain conditions, metal, electro-deposited from solutions containing certain specific impurities, takes the form of whiskers varying in diameter from about one to several microns and as long as several millimeters. A theory is presented to account for the growth of electrolytic whiskers. The theory is compared with experimental observations, and data are presented on the strength, electrical resistivity, and structure of the whiskers.

548.5

10361. GROWTH MECHANISM FOR GRAPHITE WHISKERS. G.W.Sears.
J. chem. Phys., Vol. 31, No. 2, 358-60 (Aug., 1959).

A mechanism is described which gives rise to the scroll habit which has been observed for graphite whiskers. A supersaturation region exists which would favour the postulated growth mechanism.

548.5

10362. THE ETCHING OF ICE CRYSTALS. K.Higuchi.
Acta metallurgica, Vol. 6, No. 10, 636-42 (Oct., 1958).

Polished ice surfaces were coated with a replica film of polyvinyl formal, and left in a cold chamber. Separated etch pits of geometrical shape were produced on the ice surface, and the shape of the pit figure was that of a section cut from a hexagonal column by a plane. Thus the figure of a regular hexagon was obtained on a surface parallel to the basal plane of crystallization, and the sides of this hexagon were found to be parallel to those of a vapour figure, i.e. parallel to a-axes. These etch figures can then be used as a simple method of determining the orientation of a-axes as well as of the c-axis. As etching proceeds, the bottom of the etch pit becomes a plane of mirror finish parallel to the basal plane. Continuing the etching process further, this surface develops into a stepped structure. The height of the step was measured by the shadowing method used in electron-microscope technique, and was found to vary between 3 and 16 μ, the mean being about 5 μ. This is further evidence of the layer structure of ice crystals, the layer being perpendicular to the c-axis.

548.5 : 539.213.2

EFFECT OF CATALYST SIZE IN HETEROGENEOUS NUCLEATION OF GLASS. See Abstr. 10285

548.5 : 534.39

INFLUENCE OF ULTRASONIC VIBRATIONS ON THE SOLUTION PROCESS OF SINGLE CRYSTALS. See Abstr. 9346

X-RAY CRYSTALLOGRAPHY

548.73/.74

X-RAY AND ELECTRON INVESTIGATION OF MATERIALS. See also the Section entitled "STRUCTURE OF SOLIDS"

548.732

10363. EQUI-INCLINATION WEISSENBERG INTENSITY CORRECTION FACTORS FOR ABSORPTION IN SPHERES AND CYLINDERS, AND FOR CRYSTAL MONOCHROMATIZED RADIATION. W.L.Bond.
Acta cryst., Vol. 12, Pt 5, 375-81 (May, 1959).

Increased precision of intensity measurements through the use of counting methods calls for more careful corrections. A new absorption correction table is presented for cylinders with μR running from 0 to 8 by tenths and on to 20 by units; also a table for spheres, μR running from 0 to 10 by tenths. In both tables θ runs from 0° to 90° in 5° steps. For cylinders, the correction factor for upper levels is obtained by entering the table with $\mu R \sec \nu$ in place of μR and $\Upsilon/2$ in place of θ, then multiply this value by $\cos \nu$. Tables are also given of the power series coefficients to be used in expanding absorption factors for very large cylinders. A combined polarization Lorentz correction factor is presented for the case of crystal monochromatized radiation.

548.732

10364. A UNIFIED PROGRAM FOR PHASE DETERMINATION, TYPE 1P. J.Karle and H.Hauptman.
Acta cryst., Vol. 12, Pt 5, 404-10 (May, 1959).

The new probability approach, in which the crystal structure is fixed and the Miller indices range uniformly but not independently over the integers, has been developed to yield formulas with universal application to all the space groups. The formulation is general and includes with equivalent rigour both the unequal and equal atom cases. If a requirement of rational independence of atomic coordinates is fulfilled, the formulas have exact validity. On the other hand, the formulas should still be useful even if the condition of rational independence is only partially fulfilled. In the application to a particular space group, use is made of the space group symmetries to obtain relationships among the structure factors, by means of which the general formula is suitably specialized. The present paper is concerned with the space groups comprising type 1P. A detailed procedure for phase determination in this type is described.

548.733

10365. DEFOCUSING EFFECTS IN THE SCHULZ TYPE DIFFRACTOMETER. K.Toman and M.Simerská.
Czech. J. Phys., Vol. 7, No. 3, 351-8 (1957). In German.

Develops an expression for the defocusing effect in a Schulz type diffractometer used for orientation studies of rolled sheet. Experimental results are in good agreement with the theory. The use of powder specimens as standard non-oriented material is criticized. T.Mulvey

548.733

10366. A MODIFIED X-RAY POWDER CAMERA. A.Franks.
J. sci. Instrum., Vol. 35, No. 11, 427 (Nov., 1958).

An X-ray powder camera of a standard type has been modified to improve the circularity of the film supporting rings and their concentricity with the axis of rotation of the specimen holder. J.W.Menter

548.734.4

10367. THE DETERMINATION OF THE UNIT CELL OF A PRECIPITATED PHASE BY ONE ROTATION PHOTOGRAPH OF A SINGLE CRYSTAL OF THE INITIAL PHASE CONTAINING PARTICLES OF THE NEW PHASE. Yu.A.Bagaryatskii.
Kristallografiya, Vol. 3, No. 1, 10-16 (1958). In Russian. English summary: PB 141065T-5, obtainable from Office of Technical Service, U.S. Dept. of Commerce, Washington, D.C., U.S.A. English translation in: Soviet Physics—Crystallography (New York), Vol. 3, No. 1, 8-14 (Jan.-Feb., 1958).

The method is described and applied to the study of the ω-phase in the Ti—Cr system (see also Abstr. 10384 of 1959).

548.735.4

10368. DETERMINATION OF LATTICE CONSTANTS OF CRYSTALS WITH TWO PARAMETERS BY THE METHOD OF RATIOS. M.Matějka.
Czech. J. Phys., Vol. 6, No. 6, 605-11 (Dec., 1956). In Russian.

Lattice constants are obtained from ratios of radii of three diffraction rings on a flat-plate back-reflection camera. Exact knowledge of the specimen-to-film distance is not necessary. Given approximate values of the required parameters, tables and graphs can be constructed to which ratios of measured radii are referred, and from which a final accurate answer is obtained. The author does not state whether this procedure is generally simpler than solving three simultaneous equations, but its advantages are clear for repeated measurements on the same substance. Measurements on bismuth gave a = 4.5372 ± 0.0001 kX, c = 11.8394 ± 0.0003 kX, at 25°C J.Adam

548.735.6

10369. DETERMINATION OF THE ORIENTATION OF MONOCRYSTALS WITH IRREGULAR SURFACE BY MEANS OF AN X-RAY SPECTROMETER WITH A GEIGER—MÜLLER COUNTER. M.Simerská.
Czech. J. Phys., Vol. 6, No. 6, 599-604 (Dec., 1956). In Russian.

Describes an X-ray spectrometer which records the diffracted rays by means of a GM counter; the reflecting position of the selected lattice plane is determined (for finding the orientation of a monocrystal of any size) by rotating the crystal with respect to two mutually perpendicular axes. The respective angles of rotation (ω and δ) enable pieces with predetermined orientation with regard to crystallographic axes to be cut from the crystal. F.Lachman

548.736.1

10370. THE CRYSTAL STRUCTURE OF A SIMPLE RHOMBOHEDRAL FORM OF BORON. B.F.Decker and J.S.Kasper.
Acta cryst., Vol. 12, Pt 7, 503-6 (July, 1959).

A new modification of boron, resulting from the pyrolytic decomposition of BI on a heated surface (800° to 1100° C), was found to have a simple rhombohedral structure, with a_0 = 5.057 A and $\alpha = 58.06^\circ$, space group $R\bar{3}m$, Z = 12. The atomic parameters have been obtained from a single crystal using the precession method. The structure may be described as composed of units of nearly regular icosahedra in a slightly deformed cubic close packing. This requires the use of three-centre or delta bonds, wherein two electrons are shared by three boron atoms at the vertices of an equilateral triangle.

548.736.1 : 539.2

10371. ATOM MOVEMENTS AND DISLOCATION STRUCTURES FOR PLASTIC SLIP IN SINGLE CRYSTALS OF β-URANIUM. M.L.Kronberg.
J. nuclear Mater., Vol. 1, No. 1, 85-95 (April, 1959).

The crystallographic elements of slip in single crystals of β-uranium are interpreted in terms of formalized atom movements compatible with the structural characteristics of the crystal, and dislocation structures for accomplishing the movements are derived A novel and critical part of the general problem lies in the fact that ie unit cell of the simple tetragonal lattice contains thirty atoms, hich are arranged in a sufficiently complex manner to obscure any eady identification of a slip interface. The structure of the crystal s described in detail and the over-all structural requirements of ny deformation model are deduced. It is then shown that the struc-ire permits a flow process based on a double interface, i.e. the lipping portions of crystal are separated by a volume or zone of toms which is needed to maintain structural continuity during the ow process. The width of the zone corresponds to a single lattice pacing normal to the observed slip plane of the lattice. The develop-ient and description of the associated process of plastic flow is onsidered in detail.

548.736.3

0372. THE CRYSTAL STRUCTURE OF Mn_3Al_{10}. M.A.Taylor.
cta cryst., Vol. 12, Pt 5, 393-6 (May, 1959).

The crystal structure of a previously unknown intermetallic ompound Mn_3Al_{10} has been determined by X-rays analysis. The cell imensions and atomic parameters of the structure and the inter-tomic distances between neighbouring atoms are given. The struc-ire is very similar to that of β(AlMnSi); comparisons between the vo structures are made.

548.736.3

0373. THE CRYSTAL STRUCTURE OF BADDELEYITE (MONO-LINIC ZrO_2). J.D.McCullough and K.N.Trueblood.
cta cryst., Vol. 12, Pt 7, 507-11 (July, 1959).

The structure proposed by baddeleyite by Naray-Szabo (1936) is ncorrect. Baddeleyite has the space group symmetry $P2_1/c$ with four rO_2 in the unit cell. The unit-cell dimensions found in the present work re: a = 5.169, b = 5.232, c = 5.341 A (all ±0.008 A), $\beta = 99^\circ\ 15' \pm 10'$ r—O separations are given.

548.736.3

0374. THE CRYSTAL STRUCTURE OF VCo_3. S.Saito.
cta cryst., Vol. 12, Pt 7, 500-2 (July, 1959).

X-ray analysis has shown the structure to be ordered close-acked hexagonal, $P\bar{6}m2$, with 24 atoms per unit cell. $a_0 = 5.032$ A nd $c_0 = 12.27$ A. This structure is closely related to the ordered ubic structure of the $AuCu_3$-type.

548.736.3

0375. THE CRYSTAL STRUCTURE OF YSi AND Hf_5Ge_3(C).
.Parthé.
cta cryst., Vol. 12, Pt 7, 559-60 (July, 1959).

548.736.3

0376. THE CRYSTAL STRUCTURE OF GERMANIUM SELENIDE eSe. A.Okazaki.
. Phys. Soc. Japan, Vol. 13, No. 10, 1151-5 (Oct., 1958).

Analysed using X-rays. The structure is orthorhombic with ie space group D_{2h}^{16}-Pcmn. The dimensions of the unit cell con-aining four chemical units, GeSe, are a = 4.38, b = 3.82 and = 10.79 A. It follows from the positions of all atoms, determined y means of the electron-density projection, that the structure is f a distorted NaCl type isomorphous with SnS and SnSe. The istances Ge—Se are 2.54, 2.58, 3.30 and 3.39 A.

548.736.3

0377. *X*-RAY STUDY OF VITREOUS BORIC OXIDE.
.Despujols.
. Phys. Radium, Vol. 19, No. 6, 612-14 (June, 1958). In French.

Describes the measurement of scattered intensity from films f vitreous boric oxide using Geiger counters instead of a photo-raphic plate. A triangular structure is confirmed.

T.Mulvey

548.736.3

0378. X-RAY DETERMINATION OF THE STRUCTURE OF ScB_2.
.N.Zhuravlev and A.A.Stepanova.
ristallografiya, Vol. 3, No. 1, 83-5 (1958). In Russian. English ummary: PB 141065T-5, obtainable from Office of Technical ervices, U.S. Dept. of Commerce, Washington, D.C., U.S.A. nglish translation in: Soviet Physics—Crystallography (New York), ol. 3, No. 1, 76-7 (Jan.-Feb., 1958).

The existence of compounds of scandium with boron has not reviously been reported. ScB_2 belongs to the hexagonal syngony nd is isostructural with AlB_2. The following lattice constants were btained: a = 3.140 ± 0.002 kX; c = 3.510 ± 0.002 kX; c/a = 1.118; $_x = 3.67$ g/cm^3; z = 1; space group D_{6h}^{1}-C6/mmm.

548.736.3

10379. X-RAY STUDY OF THE BORIDES YbB_6, UB_4, HoB_4 AND GdB_4. A.A.Stepanova and N.N.Zhuravlev.
Kristallografiya, Vol. 3, No. 1, 94-5 (1958). In Russian. English summary: PB 141065T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A. English translation in: Soviet Physics—Crystallography (New York), Vol. 3, No. 1, 90-1 (Jan.-Feb., 1958).

548.736.3

10380. CRYSTALS WITH LATTICE DISORDERS. STRUCTURAL INFORMATION ON PROMETHIUM OXIDE.
S.Pizzini and R.Barbieri.
Ricerca sci., Vol. 29, No. 5, 1048-52 (May, 1959). In Italian.

The distribution was investigated of the sesquioxide of Pm^{147} between an almost fluorite phase, composed of saturated cerium dioxide in lanthanum sequioxide, and an "A" type phase consisting of lanthanum sesquioxide saturated with cerium dioxide. The fact that promethium is prevalently localized in the almost fluoritic phase leads one to attribute to promethium sesquioxide a phase with "C" type structure.

548.736.3

10381. STRUCTURES OF BISMUTH OXIDES FORMED BY HEATING BISMUTH FILM IN AIR. P.S.Aggarwal and A.Goswami.
Z. Naturforsch., Vol. 13a, No. 10, 885-7 (Oct., 1958).

Two new forms of bismuth oxide ($a_0 = 5.65$ A and 7.02 A) have been observed during the oxidation of bismuth films. The well-known tetragonal variety ($a_0 = 10.93$ A and $c_0 = 5.65$ A) seems to be a superstructure form of the oxide (I).

548.736.3

10382. THE ATOMIC STRUCTURE OF SOLID SOLUTIONS OF CHROMIUM IN NICKEL. Yu.A.Bagaryatskiĭ and Yu.D.Tyapkin.
Dokl. Akad. Nauk SSSR, Vol. 122, No. 5, 806-9 (1958). In Russian.

The authors measured the diffuse scattering of X-rays for alloys containing 28 and 25 atomic percent of Cr after quenching from 800° and after annealing for 100 hours at 450°. After annealing, submicroscopic (~ 50 A) regions of an orthorhombic Ni_2Cr superlattice (of the Pt_2Mo type) were formed at 45° to the Cr base. Measurements of electrical conductivity and hardness were in agreement with this interpretation. After quenching from 800° only local order of the Ni_2Cr type was observed. The appearance of the K-state is thus associated with the formation of small regions of the ordered Ni_2Cr superlattice.

M.G.Priestley

548.736.3

10383. NEW DATA ON THE STRUCTURE OF $BiIn_2$ AND THE POSSIBLE STRUCTURE OF $TlBi_{1.27\to1.59}$, $NaHg_2$, UHg_2, UZr_2 AND TiU_2. E.S.Makarov.
Kristallografiya, Vol. 3, No. 1, 5-9 (1958). In Russian. English summary: PB 141065T-5, obtainable from Office of Technical Services, U.S.Dept. of Commerce, Washington, D.C., U.S.A. English translation in: Soviet Physics—Crystallography (New York), Vol. 3, No. 1, 3-7 (Jan.-Feb., 1958).

Among intermetallic compounds which have a hexagonal structure of the type AlB_2 there are a few cases with anomalously low ratio of axes c/a which is equal to about 0.6. On the other hand, in "normal" borides and halides of this type this ratio is roughly 1.0. The crystal structures of these anomalous compounds were studied by the powder method.

548.736.3

10384. A MORE ACCURATE DETERMINATION OF ATOMIC CO-ORDINATES OF THE METASTABLE ω-PHASE IN Ti—Cr ALLOYS.
Yu.A.Bagaryatskii and G.I.Nosova.
Kristallografiya, Vol. 3, No. 1, 17-28 (1958). In Russian. English summary: PB 141065T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A. English translation In: Soviet Physics—Crystallography (New York), Vol. 3, No. 1, 15-26 (Jan.-Feb., 1958).

See also Abstr. 10367 (1959).

548.736.3

10385. COMPLEX ALLOY STRUCTURES REGARDED AS SPHERE PACKINGS. II. ANALYSIS AND CLASSIFICATION OF REPRESENTATIVE STRUCTURES. F.C.Frank and J.S.Kasper.
Acta cryst., Vol. 12, Pt 7, 483-99 (July, 1959).

For Pt I, see Acta cryst., Vol. 11, Pt 3, 184-90 (March, 1958). The general principles and properties deduced in Pt I for the class of alloy structures with triangulated coordination polyhedra are applied in an analysis and classification of representative structures. In the main the analysis is with regard to the nature of layers and how they may be stacked and with regard to the nature of the major skeletons. Many hypothetical structures resulting from the analysis are listed and procedures are given for predicting other structure types. The relationship between alloy structures and inert gas hydrates is discussed.

548.736.4

10386. THE CRYSTAL STRUCTURE OF PLATINUM TETRA-THIONITROSYL. I.Lindqvist and J.Weiss.
J. inorg. nuclear Chem., Vol. 6, 184-6 (1958). In German.
The dimensions of the monoclinic unit cell are a = 8.57 A, b = 7.69 A, c = 11.14 A and $\beta = 101.6$. The space group is $P2_1/c$. The $Pt(SN)_4$ molecule is planar with two S_2N_2 chains in cis-position acting as bidentate ligands.

548.736.5

10387. CRYSTALLINE STRUCTURE OF THE SYSTEMS $Cd_2Nb_2O_7$—$Sr_2Nb_2O_7$ AND $Cd_2Nb_2O_7$—$NaBiNb_2O_7$. I.G.Ismailzade.
Kristallografiya, Vol. 3, No. 1, 85-6 (1958). In Russian. English summary: PB 140165T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A. English translation in: Soviet Physics—Crystallography (New York), Vol. 3, No. 1, 78-9 (Jan.-Feb., 1958).

548.736.5

10388. CRYSTALS OF POTASSIUM TETRABORATE TETRA-HYDRATE, $K_2B_4O_7.4H_2O$. Ya.Ya.Sauka.
Kristallografiya, Vol. 3, No. 1, 93 (1958). In Russian. English summary: PB 141065T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A. English translation in: Soviet Physics—Crystallography (New York), Vol. 3, No. 1, 88-9 (Jan.-Feb., 1958).
The preparation of the crystals is described and their crystal structure, determined from rotation photographs, is given.

548.736.5

10389. A GEOMETRICAL CRITERION OF THE PYROCHLORE TYPE OF STRUCTURE. V.A.Isupov.
Kristallografiya, Vol. 3, No. 1, 99-100 (1958). In Russian. English summary: PB 141065T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A. English translation in: Soviet Physics—Crystallography (New York), Vol. 3, No. 1, 96-7 (Jan.-Feb., 1958).
Many compounds with formulae $A'A''B_2O_6X$ crystallize with the pyrochlore type of structure. This type is important because cadmium pyroniobate is ferroelectric. The framework is made up of B_2O_6 octahedra sharing corners, X ions tetrahedrally surrounded by A' and A'' ions, O ions surrounded by distorted tetrahedra of 2 B ions and 2 A ions and A ions surrounded each by six O and two X ions in a deformed cube. Tolerance factors relating the ionic radii are given.

548.736.5

10390. X-RAY DIFFRACTION STRUCTURE DETERMINATION OF COBALT DIPARATOLUIDINE DICHLORIDE. T.I.Malinovskii.
Kristallografiya, Vol. 2, No. 6, 734-41 (1957). In Russian. English translation in: Soviet Physics—Crystallography (New York), Vol. 2, No. 6, 723-9 (Nov.-Dec., 1957).
The structure of cobalt diparatoluidine dichloride crystals was determined to be molecular. $CoCl_2.2H_2NC_6H_4CH_3$ crystals are monoclinic: a = 12.30, b = 4.59, c = 26.10 kX, $\beta = 93^\circ 45'$, n = 4, the space group is $C_{2}^{6}h = I^2/a$. The coordinates of all atoms, except hydrogen, were determined by a three-dimensional Patterson synthesis, using 556 independent reflections, taken from 5 layer lines when rotating the crystal around the Y axis. The distances are: Co—Cl 2.26, Co—N 1.95, N—C_1 1.45, C_4—C_7 1.50 kX. The Co—N—C_1 valence angle is 105°. The coordination number of Co is 4 and the coordination polyhedron is a tetrahedron. The paratoluidine molecule is planar.

548.737

10391. X-RAY CRYSTALLOGRAPHIC DATA ON RUBIDIUM FUMARATE, MONOHYDRATE ($Rb_2C_4H_2O_4,H_2O$).
M.P.Gupta and G.P.Dube.
Indian J. Phys., Vol. 32, No. 3, 133-6 (March, 1958).
Single crystal photographs show the salt to be triclinic with, a = 9.23 A, b = 7.51 A, c = 6.66 A; $\alpha = 81^\circ 5'$, $\beta = 96^\circ 42'$, $\gamma = 91^\circ 48'$. There are two formula units in the cell. The space group is suggested to be P1. Attention is drawn to the pseudo-monoclinic symmetry.

548.74

10392. THE SCATTERING OF ELECTRONS BY ATOMS AND CRYSTALS. II. THE EFFECTS OF FINITE SOURCE SIZE. J.M.Cowley and A.F.Moodie.
Acta cryst., Vol. 12, Pt 5, 353-9 (May, 1959).
For Pt I, see Abstr. 7655 (1959). The authors' new formulation of physical optics (Abstr. 2258 of 1958) is applied to determine to what extent the intensity distribution in electron diffraction patterns, calculated on the assumption of perfectly coherent incident radiation, should be modified to take into account the finite size and incoherence of practical electron sources. A model of an ideally incoherent source is set up. Expressions are derived for the intensity distribution in diffraction patterns obtained under various experimental conditions, including cases where partial coherence is introduced in the illumination of the specimen by the presence of an aperture. Numerical calculations for representative cases indicate that coherence considerations may become important with any extension of present day high-resolution techniques.

548.74

10393. THE SCATTERING OF ELECTRONS BY ATOMS AND CRYSTALS. III. SINGLE-CRYSTAL DIFFRACTION PATTERNS. J.M.Cowley and A.F.Moodie.
Acta cryst., Vol. 12, Pt 5, 360-7 (May, 1959).
Some aspects of the diffraction of electrons by single crystals are discussed using low-order approximations to the general theory developed in Pt I (Abstr. 7655 of 1959) and some qualitative arguments concerning general results are presented. The first-order approximation involves the treatment of a crystal as a phase object for electrons. This leads to a complex form for the atomic scattering factor and the structure factor which introduces complications to, but open up new possibilities for, the process of structure analysis from single-crystal electron diffraction patterns. It is shown that forbidden reflections cannot be generated by dynamic scattering effects in the symmetrical spot patterns obtained when the electron beam is parallel to a principle crystal axis, but lattice defects can give rise to forbidden reflections in such patterns from thick crystals.

548.74 : 537.533

10394. THE ELECTRON-OPTICAL IMAGING OF CRYSTAL LATTICES. J.M.Cowley.
Acta cryst., Vol. 12, Pt 5, 367-75 (May, 1959).
The theory of the scattering of electrons by crystals previously developed (Cowley and Moodie, A.F., 1957) is applied to determine the nature of the image of a crystal lattice obtained with an ideal electron microscope, both in- and out-of-focus. For very thin crystals the pseudo-kinematic theory is applied, and for thick crystals the dynamic theory in a two-beam approximation is used. Intensity anomalies and "stepped" structures in micrographs showing the 90 A superlattice spacing of a form of antigorite are explained as arising from simultaneous dynamic scattering of a fundamental lattice reflection and kinematic scattering of the superlattice reflection. It is shown that dynamic scattering can give rise to variations in the spacing and orientation of moiré-like fringes appearing in electron microscope images of superimposed crystals.

548.74

10395. ON THE STRUCTURE OF SELENIUM IN THIN FILMS. A.I.Andrievskii, I.D.Nabitovich and P.I.Kripyakevich.
Dokl. Akad. Nauk SSSR, Vol. 124, No. 2, 321-3 (1959). In Russian.
Two forms of selenium were identified in thin films (800-1000 A) by electron diffraction. Alpha selenium was found to be cubic with a = 2.970 ± 0.004 A and the α-Po structure. Beta Se was also cubic with a = 5.755 ± 0.007 A and a f.c.c. lattice and may be compared with Cu_2Se which has similar dimensions. The usual hexagonal selenium was also found. A.L.Mackay

548.74

10396. LATTICE-CONSTANT DETERMINATION BY ELECTRON DIFFRACTION. K.H.Brauer and W.Zwanzig.
Exper. Tech. der Phys., Vol. 7, No. 2, 66-70 (1959). In German.
Tables have been constructed for facilitating the calculation of errors due to uncertainties in the electron energy, the film radius

the radius of the diffraction ring. The effect of having the film perpendicular to the electron beam is also considered.

A.R.Stokes

548.74

97. TRANSFORMATION OF METAL LATTICES UNDER THE LUENCE OF IMPURITY ELEMENTS: TRANSFORMATION OF KEL UNDER THE INFLUENCE OF NITROGEN.

erao and A.Berghezan.

hys. Soc. Japan, Vol. 14, No. 2, 139-48 (Feb., 1959). In French.

The transformation of nickel lattices under the influence of ogen as an "insertion" impurity was studied. For this study, thin crystalline and monocrystalline layers of evaporated nickel were ted in an atmosphere of ammonia. This nitriding process was owed kinetically by electron diffraction. Using these techniques, as shown that the "insertion" of nitrogen atoms takes place in cessive steps. First, a considerable expansion of the initial f.c.c. ce of nickel (from a = 3.52 to a = 3.72 A) is observed with the nation of Ni_4N. Then, if the nitriding is continued, this f.c.c. ce of expanded nickel (Ni_4N) is transformed into a hexagonal ce of Ni_3N. The exact structure of these nitrides was determined a mechanism of the transformation from the expanded cubic el lattice (Ni_4N) to the hexagonal nickel lattice (Ni_3N) is proposed. s mechanism consists, in part, of a series of microslips on the) plane and in the $[11\bar{2}]$ direction of nickel atoms, similar to e produced in the martensitic transformation of cobalt, which sforms the stacking order of the $\{111\}$ planes of the f.c.c. lattice the stacking order of the $\{0001\}$ planes of the hexagonal lattice. ddition, the diffusion of nitrogen results in another stacking sformation from the cubic $\{1\bar{1}0\}$ planes into the $\{1\bar{2}10\}$ planes of hexagonal variety.

548.74

98. CUBIC MODIFICATION OF $(NH_4)_2GeF_6$.

.Vainshtein and R.N.Kurdyumova.

stallografiya, Vol. 3, No. 1, 29-31 (1958). In Russian. English mary: PB 141065T-5, obtainable from Office of Technical vices, U.S. Dept. of Commerce, Washington, D.C., U.S.A. lish translation in: Soviet Physics—Crystallography (New York), 3, No. 1, 27-30 (Jan.-Feb., 1958).

The existence of a cubic modification has been established by tron diffraction, and the structure studied in detail.

548.74

99. ON THE TEMPERATURE DIFFUSE SCATTERING OF ECTRONS. I. DERIVATION OF GENERAL FORMULAE.

akagi.

hys. Soc. Japan, Vol. 13, No. 3, 278-86 (March, 1958).

The perturbation theory of the temperature diffuse scattering of ctrons is presented taking account of the fact that each of the nary and secondary waves in the crystal consists of many plane es. Formulae for the intensity of the diffuse scattering from a atomic crystal forming a primitive lattice are obtained for each he perturbation potentials due to Bloch and to Nordheim. When n of the primary and secondary waves does not excite any Bragg ections and can be given by a plane wave, the Nordheim potential es the same result and the Bloch potential gives practically the ne result as that of the current X-ray diffraction theory applied lectron diffraction. The result may be applied to explain the forion of the Kikuchi pattern by the temperature diffuse scattering the anomalous intensity variation of the diffuse spot from some gle crystals.

548.74

10400. ON THE TEMPERATURE DIFFUSE SCATTERING OF ELECTRONS. II. APPLICATION TO PRACTICAL PROBLEMS.

S.Takagi.

J. Phys. Soc. Japan, Vol. 13, No. 3, 287-97 (March, 1958).

The results of the perturbation theory of the temperature diffuse scattering of electrons developed in the preceeding abstract are applied to practical problems with the assumption of two plane waves. It is shown that the intensity of the diffuse scattering does not become infinite at a reciprocal lattice point as it does in the current theory but remains finite, that the temperature diffuse scattering gives rise to Kikuchi patterns, and that the intensity of diffuse spots changes abruptly when the incident wave excites a Bragg reflection. The anomalous intensity variation of the diffuse spots from the surface of some single crystals may be due to this effect. In the Bragg case the direction of the diffuse scattering can be obtained by the modified Ewald construction which replaces the Ewald sphere by the equi-energy surface in the reciprocal space. The possibility of treating the Kikuchi pattern due to the inelastic collision of incident electrons with lattice electrons by the present method is also discussed.

548.74

10401. DEUTERIUM POSITIONS IN LANTHANUM DEUTEROXIDE BY NEUTRON DIFFRACTION. M.Atoji and D.E.Williams.

J. chem. Phys., Vol. 31, No. 2, 329-31 (Aug., 1959).

The deuterium positions in $La(OD)_3$ were determined by the neutron diffraction method. No hydrogen bonding was found in this structure. The close packing structure around the deuterium atom is characterized by the average distances of D—D = 2.29 A and D—O = 2.74 A. The infrared absorption spectra of $La(OD)_3$ and $La(OH)_3$ are briefly discussed.

548.74

10402 STRUCTURES OF CALCIUM DICARBIDE AND URANIUM DICARBIDE BY NEUTRON DIFFRACTION.

M.Atoji and R.C.Medrud.

J. chem. Phys., Vol. 31, No. 2, 332-7 (Aug., 1959).

The C—C distances of the C_2 groups in CaC_2 and UC_2 were determined by the powder neutron diffraction method. The C—C distance in CaC_2 is 1.20 ± 0.01 A, equal to the triple bond C—C distance, but not 1.4 A as reported previously. UC_2 is isostructural with CaC_2 and has the C—C distance of 1.34 ± 0.01 A, essentially that of a C—C double bond. The interatomic distances in CaC_2, UC_2, LaC_2, and La_2C_3 are discussed in connection with the electronic configuration of the C_2 group.

548.74

10403. CRYSTAL STRUCTURE OF HELIUM ISOTOPES.

J.Donohue.

Phys. Rev., Vol. 114, No. 4, 1009 (May 15, 1959).

The neutron diffraction data of Henshaw (Abstr. 8535 of 1958) for crystalline He^4 have been treated by the method of least squares to obtain revised values of the lattice constants and their standard errors. The values so obtained, together with the pressure—volume—temperature data of Dugdale and Simon (Abstr. 6725 of 1953), are used to make a direct comparison with the interatomic distances and molar volume for β-He^3, which is also hexagonal close-packed.

548.74 : 539.19

C—H DISTANCE IN THE CRYSTAL STRUCTURE OF PARAFFINS. See Abstr. 10202

GEOPHYSICS

550.3 : 534.131

10404. TORSIONAL OSCILLATIONS OF THE EARTH AND SOME RELATED PROBLEMS. H.Takeuchi.
Geophys. J., Vol. 2, No. 2, 89-100 (June, 1959).

Variational calculus methods are applied to the problem of torsional oscillations of elastic spheres of variable densities and elasticities and to the corresponding plane-Love-wave problem for vertically heterogeneous media. The methods work well and give a phase velocity curve for the model earth, the internal constitution of which was inferred by Bullen. The corresponding displacement distributions are given.

550.312

10405. ON THE INTERPRETATION OF GRAVITY ANOMALIES WITH UNKNOWN BODY DENSITY. I.P.Nedelkov.
C.R. Acad. Bulg. Sci., Vol. 11, No. 5, 347-50 (Sept.-Oct., 1958).

The notion of a gravimetric family as the manifold of all surfaces which determine homogeneous ore bodies having the same gravity anomaly is introduced. Some properties of gravimetric families are outlined and a method for their approximate determination is submitted. T.R.Carson

550.312 : 525.3

10406. DETERMINATION OF THE EARTH'S GRAVITATIONAL POTENTIAL FROM OBSERVATIONS ON SPUTNIK 2 (1957β). A.H.Cook.
Geopnys. J., Vol. 1, No. 4, 341-5 (Dec., 1958).

Observations by the Royal Aircraft Establishment of the rate of rotation of the orbital plane of Sputnik 2 are combined with Jeffreys's equations for the coefficients J and D in the spherical harmonic expansion of the earth's gravitational field to give revised estimates of J and D. The relative uncertainties of the results emphasize the great value of satellite observations and the need for a revision of the spherical harmonic analysis of surface gravity. Comparison of the value of e^{-1} with that deduced from the constant of precession indicates that the earth is not in a hydrostatic state.

550.385 : 551.510.535

IONOSPHERIC DISTURBANCES ASSOCIATED WITH MAGNETIC STORMS AT KODAIKANAL. See Abstr. 9066

551.46 : 535.51

10407. OPTICAL METHOD OF INVESTIGATION OF THE OCEANS: THE $p-\beta$ DIAGRAM. A.Ivanoff.
J. Opt. Soc. Amer., Vol. 49, No. 1, 103-4 (Jan., 1959).

The use of a $p-\beta$ diagram to characterize ocean water, where p is the degree of polarization of the light scattered by the water at 90° to the direction of the incident light and β is the scattering coefficient of the water, is discussed. A diagram showing the values of p and β for samples taken at different depths from the Mediterranean Sea is given. It illustrates the possibility of using such a diagram to detect accumulations of suspended particles and to study hydrology. H.G.Jerrard

ATMOSPHERE . IONOSPHERE

551.510.3

10408. A NOTE ON SATELLITE DENSITY OBSERVATIONS. J.W.Reed.
Bull. Amer. Meteorol. Soc., Vol. 40, No. 6, 310-11 (June, 1959).

Atmospheric temperatures near the 50 km level, as indicated by acoustic observations, are 10-20% higher than those derived from rocket ascents. This correction would reduce the high values of upper-atmosphere densities around 250 miles obtained from Sputnik I observations by a factor of 2-2$\frac{1}{2}$. Similarly, an increase by 25% of the adopted I.C.A.O. absolute temperature at this same altitude would suffice to explain the apparently anomalous air density. D.R.Barber

551.510.4

10409. ON THE PRESENCE OF HYDROXYL, AND SODIUM IN THE UPPER ATMOSPHERE. A.Dauvillier.
C.R. Acad. Sci. (Paris), Vol.248, No. 13, 1901-3 (April 1, 1959).
In French.

Reasons are advanced for believing that upper atmosphere OH, and Na, both originate from the capture of interplanetary H, and Na, by the orbital motion of the earth. D.R.Barber

551.510.4

10410. ORIGIN OF SODIUM AND LITHIUM IN THE UPPER ATMOSPHERE. T.M.Donahue.
Nature (London), Vol. 183, 1480-1 (May 23, 1959).

A critical discussion of the results of several recent observations and papers by different authors. The evidence for the meteoric source of Na and Li seems to be based on poor assumptions, especially that of linear relationship between the increase of intensity of scattering and abundance. Owing to nuclear explosions the Li—Na intensity measurements tend to become less useful in solving the problem of the origin of atmospheric Na. Recent observations point to the marine origin. F.Lachman

551.510.535

10411. THE FIRST IONOSPHERIC VERTICAL SOUNDING ABOVE YUGOSLAVIA. D.Bajić.
Bull. sci. Cons. Acad. Yougoslavie, Vol. 4, No. 4, 108-9 (April 1959).

Details are given of the automatic ionospheric recorder used. Sample ionograms are presented and some results are discussed. H.J.A.Chivers

551.510.535

10412. MAGNETIC CONTROL ON THE VARIATIONS OF THE CRITICAL FREQUENCY OF THE F_2 LAYER OF THE IONOSPHERE. R.G.Rastogi.
Canad. J. Phys., Vol. 37, No. 7, 874-9 (July, 1959).

The paper discusses the comparative influence of the true magnetic and smooth geomagnetic latitudes on the diurnal and latitudinal variations of the critical frequency of the F2 layer (f_0F2) at low latitudes. The diurnal variations of f_0F2 are shown to differ considerably at stations having the same geomagnetic latitude, but the discrepancies disappear when the true magnetic latitude is taken into consideration. The latitudinal variation of noon values of f_0F2 is also shown to present discrepancies for low latitude stations in the geomagnetic latitudes plot, but on true magnetic latitude plots the points fall regularly along a smooth curve.

551.510.535

10413. ON THE ELECTRON PRODUCTION RATE IN THE F_2 REGION OF THE IONOSPHERE. S.Datta.
Indian J. Phys., Vol. 32, No. 10, 483-91 (Oct., 1958).

A column of unit cross-section of this region, extending from the "bottom" to the height of its maximum electron density, is divided into four columns of equal length. Mean production rate in each of the columns is calculated. For this purpose, diurnal variation of the total number of electrons in each of the columns and the height variation of the attachment coefficient suggested by Ratcliffe et al. (1956) are utilized. This method of computation leads to a regular consistent diurnal variation of the electron production rate, with a single peak at about half an hour before noon, and eliminates the anomalous results that are sometimes obtained when other methods of computation are employed.

551.510.535 : 523.745

10414. EFFECT OF ENHANCED SOLAR ACTIVITY ON THE F_2 REGION DRIFTS AT WALTAIR.
B.Ramachandra Rao and E.Bhagiratha Rao.
J. sci. industr. Res., Vol. 17A, No. 12 (Suppl.), 59-62 (Dec., 1958).

Evidence of marked anomalies in the diurnal variation of F2 region drifts observed at 17°N, 83°E are reported for days on which prominent solar flares occurred. These results can be explained by invoking a reversal of the S field in the dynamo region at this latitude on solar flare days. H.J.A.Chivers

551.510.535

415. DIURNAL VARIATION OF IONOSPHERIC ABSORPTION ON 5 Mc/s AT WALTAIR DURING THE I.G.Y.
Ramachandra Rao and K.V.V.Ramana.
sci. industr. Rés., Vol. 17A, No. 12 (Suppl.), 56-8 (Dec., 1958).

Using the reflected-pulse technique, the dependence of absorption Waltair (17° N, 83° E) on the cosine of the solar zenith angle has en determined. A mean value of 1.25 was found for the exponent the cosine term, and the average ratio of summer to winter noon-ne absorption is 2.2. H.J.A.Chivers

551.510.535 : 621.396.8

416. ON THE MEASUREMENT OF VIRTUAL HEIGHT. I.Kay.
.E. Trans Antennas and Propagation, Vol. AP-7, No. 1, 11-14 n., 1959).

A time dependent definition of the virtual height of a reflected ve train is suggested. This definition is such that its accuracy reases as the width of the incident pulse increases. Moreover, s theoretically possible to obtain an estimate of the virtual height h as small an error as desired, no matter what the nature of the flecting medium. Suppose an incident pulse having width w and a rrier frequency ω_0 produces a reflected wave which, when mea-red at a fixed point x = 0 in space, is $R(\omega_0, w, t)$. A suggested inition of the virtual height $h'(\omega_0)$ is given in terms of w and ω_0. is relation holds for any physically reasonable incident wave in and is independent of its envelope shape. An example is given a reflected wave whose virtual height cannot be determined by pection in the usual manner. The expression given here for the tual height provides the correct result.

551.510.535

417. A THEORETICAL STUDY OF THE DYNAMICAL RUCTURE OF THE IONOSPHERE. T.Shimazaki.
Radio Res. Lab. (Tokyo), Vol. 6, 109-241 (March, 1959).

An historical survey of the study of the dynamical effects of nperature and tidal variations in the ionosphere is made. The apman theory is outlined and criticized. It is extended to include riable scale height, non-uniform recombination coefficient, and ospheric movements. Observational material from all over the rld is analysed and the Chapman model shown to be inadequate to plain the experimental data. The Bradbury model is found to be tter in every respect. The variations of foE and foF1 with solar nith angle is examined in detail and compared with the Chapman eory. It is suggested that the discrepancies with the theory result m vertical drift motions due to the Sq current system.
H.J.A.Chivers

551.510.535 : 523.164.3

418. RADIO REFLEXIONS FROM THE MOON AND SOLAR DRONA. O.Burkard.
ture (London), Vol. 183, 1180 (April 25, 1959).

It is shown that recent measurements of the electron density in e space around the earth, may, in certain circumstances, necess-ite a modification of the simple formula which has been used to lculate the total electron content of the ionosphere from measure-nts of the Faraday rotation. C.Hazard

551.510.535 : 523.164.4

419. OBSERVATIONS ON GALACTIC RADIATION AT 30 Mc/s. V.Somayajulu and N.Narayana Rao.
sci. industr. Res., Vol. 17A, No. 12 (Suppl.), 54-6 (Dec., 1958).

A wide-beam aerial directed vertically has been used to make continuous record of cosmic noise received on 30 Mc/s at Madras 3° N, 80° E). Preliminary results show intense daytime absorption mmencing and ending abruptly with sunrise and sunset respect-ely. H.J.A.Chivers

551.510.535

RADIO-WAVE PROPAGATION IN THE IONOSPHERE. See also e Section entitled "ELECTROMAGNETIC WAVES AND OSCILLA-ONS".

551.513 : 539.163

420. COSMIC RAY PRODUCED RADIOISOTOPES FOR TUDYING THE GENERAL CIRCULATION IN THE ATMOSPHERE. Lal.
dian J. Meteorol. Geophys., Vol. 10, No. 2, 147-54 (April, 1959).

The potential significance of these isotopes in the field of eteorology arises because of the following features in their pro-ction and properties-(1) Several radioisotopes are available whose half-lives are comparable to time scales involved in the atmospheric circulation. Four of the isotopes (S^{35}, Be^7, P^{33}, and P^{32}) have half-life periods ranging from three months to a fortnight, and one (Na^{22}) has a half-life of about two and a half years, and (2) Isotope production is continuous, constant, strongly dependent on the latitude and altitude in the atmosphere and indenpendent of meteorological factors. These isotopes can be used for investigating the nature of circulation of air in the troposphere and the detailed mechanism of exchange of air between the stratosphere and the troposphere. Experimental work on the use of these isotopes in meteorology has so far been confined mainly to determination of the concentration in rain water. Results of these investigations are summarised.

551.513 : 525.3

ATMOSPHERIC TIDES AND EARTH SATELLITE OBSERVATIONS. See Abstr. 9168

551.515

10421. EXPERIMENTAL TECHNIQUE FOR STUDYING ATMOSPHERIC TURBULENCE.
R.N.Wolfe, C.A.Morrison and H.R.Condit.
J. Opt. Soc. Amer., Vol. 49, No. 8, 829-30 (Aug., 1959).

Describes an experimental method of observing the effect of small inhomogeneities in the atmosphere, by studying the "shadow bands" produced on a screen from two small sources at a great distance. J.M.Hough

551.521.3

10422. SOLAR LYMAN-β FLUORESCENCE MECHANISM IN THE UPPER ATMOSPHERE. J.C.Brandt.
Astrophys. J., Vol. 130, No. 1, 228-40 (July, 1959).

The atmospheric Bowen mechanism is investigated on the basis of Chandrasekhar's theory of radiative transfer, and the total day airglow intensity of λ 8446 O I is estimated at 500 rayleighs. The twilight intensity is negligible (about 1 rayleigh), in disagreement with Shklovskii's estimate. The distribution of atomic oxygen above 100 km can be deduced from the theory of radiative transfer and observations of λ 8446 O I at different heights.

551.521.3

10423. TRANSPARENCY OF THE LOWER LAYERS OF THE ATMOSPHERE IN CERTAIN SPECTRAL INTERVALS IN THE REGION BETWEEN 0.3 AND 1 μ. O.I.Popov.
Optika i Spektrosk., Vol. 3, No. 5, 504-13 (Nov., 1957). In Russian.

Reports measurements of transparency of the lower layers of the terrestrial atmosphere at 313, 546 and 1014 mμ. The transparency was measured photoelectrically at a country site. The experimental curves of the dependence of the attenuation coefficient wavelength are given for the spectral region 310-1000 mμ under the conditions of visibility from 1.6 to 58 km. The dimensions of the scattering particles and their number per unit volume of air are deduced. A.Tybulewicz

551.521.326

10424. OXYGEN RED LINES IN THE AIRGLOW. I. TWILIGHT AND NIGHT EXCITATION PROCESSES. J.W.Chamberlain.
Astrophys. J., Vol. 127, No. 1, 54-66 (Jan., 1958).

Various mechanisms for exciting the red lines at twilight are investigated. Computations are presented on the twilight enhancement to be expected from resonance scattering of sunlight at λ 6300, which arises from the nebular transition of [O I]. The problem differs from that for λ 5893 of sodium in two important respects: For [O I], secondary scatterings and self-absorption can be neglected, and collisional deactivation must be included. The numerical calculations are based on an adopted distribution of O and O_2, with the latter constituent assumed to be the source of deactivation. The transmission function for the lower atmosphere is replaced with a simple screening height; this method of comparing theory and observations might be improved if the deactivation coefficient and model atmosphere were precisely known. Observations, when compared with the theory suggest that virtually none of the [O I] twilight arises from resonance scattering. Similarly, dissociation of O_2 in the Schumann—Runge continuum contributes, but does not give by itself the observed absolute intensity or variation in intensity. The main excitation probably arises from dissociative recombination of O_2^+. An elementary theory of the evening twilight variation is presented with this hypothesis, and fair agreement with observations is obtained. The same mechanism probably explains the nightglow, with the height of emission in the neighbourhood of 250-300 km. It is speculated that erratic variations and the predawn enhancement observed in winter may arise from diffusion (and other dynamic effects) of ions and O_2 in the lower part of the F region.

551.521.326

10425 OXYGEN RED LINES IN THE AIRGLOW. II. COLLISIONAL DEACTIVATION EFFECTS. M.J.Seaton.
Astrophys. J., Vol. 127, No. 1, 67-74 (Jan., 1958).

Deactivation rates for upper-atmosphere metastable atomic oxygen may be deduced from (1) time variations in auroral emissions; (2) emission heights much greater than 100 km for the nightglow red lines, despite the fact that excitation must occur at 100 km; (3) observations of the [O I] red-to-green intensity ratio in aurorae. The auroral observations may be explained in two ways: (1) assuming deactivation rates proportional to air density and a red-to-green excitation ratio S_2/S_3 varying with altitude, as would be expected if discharge mechanisms are operative, or (2) assuming S_2/S_3 independent of altitude and deactivation rates not proportional to gas density, which may be the case if resonance collisions $O(^1D) + O_2(^3\Sigma) \rightleftharpoons O(^3P) + O_2(^1\Sigma, v = 2)$ are important. In both cases the deduced deactivation rates are consistent with suppression of the airglow red-line emission at 100 km.

551.526.326

10426. OXYGEN RED LINES IN THE AIRGLOW. III. THE DAYGLOW. J.C.Brandt.
Astrophys. J., Vol. 128, No. 3, 718-23 (Nov., 1958).

Dissociative recombination of O_2^+ and ultraviolet dissociation of O_2 are considered as mechanisms contributing to the λ 6300 [O I] dayglow emission, and the total intensity is found to be the order of 50 kilorayleighs.

551.521.326

10427. ON THE CHANGES OF COLOUR OF THE TWILIGHT SKY. N.B.Divari.
Dokl. Akad. Nauk SSSR, Vol. 122, No. 5, 795-8 (1958). In Russian.

Information about the earth's atmosphere is found by comparing photoelectric measurements of the distribution of energy in the light of the twilight sky with theoretical calculations using first-order dispersion and allowing for absorption by ozone.

G.A.Chisnall

551.521.326

10428. THE TWILIGHT RADIATION AT 6708 A. G.Kvifte.
Nature (London), Vol. 183, 1384-5 (May 16, 1959).

Using a grating spectrograph the author found, in both the second- and the third-order spectra, very sharp but faint lines of wavelength 6707.7 ± 0.5 A, which seem to confirm the recent findings of Delannoy and Weill (Abstr. 1959 of 1959). A decrease of the Li layer relative to the Na layer (Abstr. 4148 of 1959) has not been confirmed.

F.Lachman

551.521.9

10429. VAN ALLEN RADIATION OF SOLAR ORIGIN. P.J.Kellogg.
Nature (London), Vol. 183, 1295-7 (May 9, 1959).

It is shown that a diffusion process is incapable of supplying low-energy solar particles to the inner Van Allen zone since these will be scattered earthward before they can diffuse very far. Of alternative sources for the low-energy particles, those associated with low-latitude aurorae, neutron decay, and high-altitude nuclear explosions appear likely.

D.R.Barber

551.543

10430. CONTRIBUTION OF THE HUMIDITY TERM IN THE FORMULA FOR REDUCTION OF PRESSURE TO SEA LEVEL. K.N.Rao.
Indian J. Meteorol. Geophys., Vol. 9, No. 4, 323-32 (Oct., 1958).

For reduction of pressure to sea level, the U.S.A. and Canadian meteorological services introduce a correction for humidity with the expression

$$T_{mv} = T_s + \frac{aH}{2}p + e_s C_h,$$

where T_{mv} is the integrated mean virtual temperature of the air column in °H, T_s and e_s the surface temperature and vapour pressure, a the assumed lapse rate in the air column, H_p the station elevation in gpm and C_h a function of H_p expressed in deg C/mb. The last term in the equation is the humidity correction. The values obtained in this expression for T depend upon (1) a constant lapse rate and (2) the fact that the variation of vapour pressure with height is in accord with Hann's formula. In an examination of the humidity correction for conditions in India, it is found that an increase of 1°C in T_{mv} decreases the pressure (reduced to sea level) by 0.3 mb for stations at heights of 800 gpm, while for (2) the correction is less than 0.2 mb and negligible for practical purposes. For India the use of an annual mean value of vapour pressure in preparing barometer reduction tables will introduce only a negligible error but a table of corrections for variation in vapour pressure may be used if more accurate values are required.

R.S.Read

551.574.1 : 532.65

THEORETICAL ESTIMATE OF THE COLLECTION EFFICIENCIES OF SMALL DROPLETS. See Abstr. 9302

551.577

10431. EVAPORATION OF SPHERICAL DROPS OF WATER FALLING FREELY THROUGH THE ATMOSPHERE.
S.Panchev.
C.R. Acad. Bulg. Sci., Vol. 10, No. 5, 355-8 (Sep.-Oct., 1957).
In Russian.

The equation of motion of drops is formulated and solved. It is found that the velocity of the drops is proportional to the square root of their radius.

R.Eisenschitz

551.593.12

10432. THE INFLUENCE OF METEOROLOGICAL CONDITIONS ON THE INTENSITY OF LIGHT SCINTILLATION NEAR THE EARTH'S SURFACE.
V.I.Tatarskii, A.S.Gurvich, M.A.Kallistratova and L.V.Terent'eva.
Astron. Zh., Vol. 35, No. 4, 623-6 (1958). In Russian. English translation in: Soviet Astron.–AJ (New York), Vol. 2, No. 4, 578-81 (July-Aug., 1958).

The results of an experimental investigation of the dependence of light scintillation of a distant terrestrial source on meteorological conditions are given. A high correlation (the coefficient of correlation is 0.92) was found for the intensity of scintillation and the vertical gradient of the mean temperature. This is in good agreement with the theory of the phenomenon studied.

551.594 : 621.396.821

10433. SELECTIVE ANNOTATED BIBLIOGRAPHY ON THUNDERSTORM SFERICS (SUPPLEMENT). G.Thuronyi.
Meteorol. Abstr., Vol. 10, No. 4, 588-624 (April, 1959).

Brings up to date the bibliography published ibid., Vol. 4, No. 11 (Nov., 1953). 158 refs.

551.594.14

10434. AIR RADIOACTIVITY IN CATANIA.
B.Cantone, G.Pappalardo and R.Ricamo.
Nuovo Cimento, Vol. 12, No. 1, 84-8 (April 1, 1959).

β-activity has been measured by air filtration: values of $2\text{-}50 \times 10^{-13}$ curies/litre were found for radon products, $0.5\text{-}5 \times 10^{-15}$ curies/litre for thoron products and $1.2\text{-}2 \times 10^{-16}$ curies/litre for artificial radioactivity. Measurements were also made in closed rooms and were found to be as high as 2×10^{-11} curies/litre in several rooms which had been closed for three days.

J.M.Hough

551.594.5

10435. U.H.F. AURORAL RADAR OBSERVATIONS. B.C.Blevis.
J. geophys. Res., Vol. 63, No. 4, 867-8 (Dec., 1958).

A few examples of auroral detections obtained during preliminary trials of equipment at Ottawa using 10 kW radar transmitters on frequencies of 488 and 944 Mc/s.

G.M.Brown

551.594.51 : 621.396.969

10436. PRELIMINARY RESULTS OF 400 Mc RADAR INVESTIGATIONS OF AURORAL ECHOES AT COLLEGE, ALASKA.
R.L.Leadabrand, L.Dolphin and A.M.Peterson.
I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 2, 127-36 (April, 1959).

Results of radar investigations of auroral ionization at a frequency of 398 Mc/s are described. The radar detected auroral echoes at College, Alaska (near Fairbanks), even when the line of sight from the transmitter did not intersect the earth's magnetic field lines at perfect perpendicular incidence. The auroral echoes were observed with off-perpendicular intersection angles as great as 10°. The requirement for near-perpendicular intersection of the

ar beam with the earth's magnetic field is therefore met. The
oral echoes at 398 Mc/s were seen frequently. Occasionally they
e very strong; those of highest amplitude were as much as 27 dB
ve the receiver noise level. The echoes were detected over a
tively large echoing region corresponding to bearings within
° of geomagnetic north, and elevation angles of $0°-17°$. Two types
uroral echoes were observed — discrete and diffuse. The
discrete echoes corresponded roughly to reflections from visual auroral forms seen at night. The diffuse echoes corresponded to reflections from a large echoing region that apparently existed most often during daylight hours. Estimates of the wavelength, λ, dependence of auroral echo power, although quite crude, are deduced as λ^{10} for the radar site at College, Alaska, and λ^5 for sites where perpendicular reflection can be obtained.

BIOPHYSICS
PHYSIOLOGICAL PHYSICS

576.3

37. CELLULAR RESPONSES. W.Bloom.
. mod. Phys., Vol. 31, No. 1, 21-29 (Jan., 1959).
The organisation of living cells was investigated with the light
roscope and dividing cells in tissue culture by time-lapse
rocinematography. Some key frames from the films are repro-
ed. With these techniques a comparison is made of (1) normal
ding newt cells, (2) cells irradiated as a whole by u.v. or
zing radiations and (3) cells irradiated locally with the same
ations as (2) but in the form of a micro-beam. It was found that,
he number of abnormalities produced by 200 Kv X-rays or by
over the whole cell depends on the amount of radiation applied;
ocalized irradiation of chromosomes with a few tens of protons
es them sticky. No abnormalities result when a small area of
plasm receives 28 300 protons; (3) u.v. on a small area of cyto-
m prevents spindle formation or destroys it if already formed.
uch cells groups of whole chromosomes (not chromatids) move
t, usually in unequal numbers, to form the daughter nuclei of the
ding cell; the spindle seems to provide a mechanism for guiding
chromatids in anaphase; (4) localized u.v. on chromosomes
nges the refractive index at the affected area and such spots stain
faintly for DNA and absorb very little at 260 mμ. J.Iball

576.3

38. FINE STRUCTURE OF CYTOPLASM: THE ORGANIZATION
MEMBRANOUS LAYERS. F S.Sjöstrand.
. mod. Phys., Vol. 31, No. 2, 301-18 (April, 1959).
Membranes of various dimensions and different organization
ear to represent a common and basic principle of organization
ne cytoplasm. Some examples of such membranes are given
electron micrographs) and possible interpretations in terms of
ecular structure are suggested. The functional significance of the
ous membranes is discussed. It is stressed that the cytoplasm
ifferentiated into a limited number of structurally and function-
different components. J.Iball

576.3

9. QUANTITATIVE STUDIES ON MAMMALIAN CELLS IN
RO. T.T.Puck.
. mod. Phys., Vol. 31, No. 2, 433-48 (April, 1959).
A description of the research carried out at the University of
rado to develop methods which have made it possible to study
mmalian cells by the techniques of microbial genetics. A simple
ntitative method for growing single cells into colonies was
eloped which is identical in principle, and only slightly more
plex in practice, than the plating method of bacteriology. The
of the new techniques is illustrated by their application to the
y of the action of high-energy radiation on mammalian cells.
result of these studies is the estimation that, under the conditions
e experiments, 50 r is the average dose required to produce one
ble chromosome break per cell and from this it is further
mated that with a background exposure of 0.1 r per year, in
ears the accumulated dose is sufficient to have produced gross
mosome damage in one-seventh of all the body cells.
J.Iball

576.72

0. MEMBRANE TRANSPORT. R.W.Berliner.
. mod. Phys., Vol. 31, No. 2, 342-8 (April, 1959).
A review of work carried out mainly in the past ten years on the
sport of ions across isolated membranes. The results obtained
Ussing and his collaborators, mainly on frog skin, are described
in considerable detail and they are related to the results of other workers who used different membranes. Radioactive tracers are being used for these investigations. The processes involved appear to be limited in number and are essentially the same in all cell types and species. It is concluded that the study of simple systems may given results applicable to more complex and less accessible ones.
J.Iball

576.72

10441. FIBROUS PROTEINS OF MUSCLE. A.J.Hodge.
Rev. mod. Phys., Vol. 31, No. 2, 409-25 (April, 1959).

The use of light and electron microscopy, X-ray diffraction and other techniques in the study of muscle proteins is reviewed and some new data on tropomyosin and paramyosin are presented. The following proteins are considered (a) actin, (b) myosin and two degradation products, "heavy" and "light" meromyosin, (c) tropomyosin, (d) paramyosin. Twenty-one electron micrographs are reproduced, many of them showing the internal pattern in crystals of (c) and (d). From a consideration of the structural patterns observed and the physical and chemical properties of muscle components it is suggested that muscle might be regarded as a complex mixed macromolecular "crystal" capable of changes in physical state in order to convert chemical energy into mechanical work. Sixty-seven references.
J.Iball

577.1

10442. CHEMICAL SPECIFICITY IN BIOLOGICAL SYSTEMS.
W.Kauzmann.
Rev. mod. Phys., Vol. 31, No. 2, 549-56 (April, 1959).

Some typical examples of biological specificity involving well defined chemical agents are described. The reactions are (a) antigen —antibody, (b) enzyme—substrate and (c) the binding of small molecules. The molecular basis of specificity is considered and the idea of specificity as a form of organization is reviewed. J.Iball

577.18

10443. HORMONE REGULATION. DeW.Stettin,Jr.
Rev. mod. Phys., Vol. 31, No. 2, 563-8 (April, 1959).

A review of the nature of hormones, their origin, their site of action and the manner in which they function. There is as yet little information which would link the structure of a hormone with its function. J.Iball

577.3

10444. BIOLOGICAL TRANSDUCERS AND CODING. O.H.Schmitt.
Rev. mod. Phys., Vol. 31, No. 2, 492-503 (April, 1959).

The various kinds of structures in biology which transform energy of one kind into another kind, in the context of communication, are described and examples are given of the way in which biophysical techniques are being applied to study their functioning. Included in the problems of transducers is the question of coding of information, as it is by means of codes, often elaborate, that the necessary economy of operation can be achieved. The use of physical and engineering analogues is not likely to be adequate to solve the biological problems and specific biological theory and techniques must be developed. J.Iball

577.3 : 537.311.33

RELATION BETWEEN EXCITON BANDS AND CONDUCTION BANDS IN MOLECULAR LAMELLAR SYSTEMS. See Abstr. 9609

591.111.3 : 612.11

10445. BLOOD COAGULATION — A STUDY IN HOMEOSTASIS. D.F.Waugh.
Rev. mod. Phys., Vol. 31, No. 2, 557-62 (April, 1959).

In the case of the blood vascular system homeostasis includes the mechanisms involved in sealing a wound in a blood vessel and the mechanisms which maintain the fragile walls of capillaries such that proteins and cells do not escape from the circulation. As an example, coagulation of the blood is considered in the light of recent experimental data. J.Iball

591.181 : 612.8

10446. SOME QUANTIFIABLE ASPECTS OF THE ELECTRICAL ACTIVITY OF THE NERVOUS SYSTEM (WITH EMPHASIS UPON RESPONSE TO SENSORY STIMULI). W.A.Rosenblith.
Rev. mod. Phys., Vol. 31, No. 2, 532-45 (April, 1959).

A study of the electrical responses, in the human nervous system, evoked by sensory stimuli. In addition to measuring the electric potentials of single electrodes an attempt is made to observe the pattern of responses when a "population" of neural units are mutually interacting. In this way it is hoped to study the "state" of the organism as it reacts selectively to sensory stimulation. The interpretation of electro-encephalogram patterns is an essential part of the techniques employed. J.Iball

591.182

10447. MECHANISMS OF SYNAPTIC TRANSMISSION. B.Katz.
Rev. mod. Phys., Vol. 31, No. 2, 524-31 (April, 1959).

An examination of the evidence which is available on the properties and function of "synapses", the points of contact between one nerve cell and the next, and between nerve cells and muscle fibres. Electrical and chemical transmissions are involved. J.Iball

591.185

10448. INITIATION OF NERVE IMPULSES IN RECEPTOR AND CENTRAL NEURONS. T.H.Bullock.
Rev. mod. Phys., Vol. 31, No. 2, 504-14 (April, 1959).

A discussion of current ideas on the treatment of sense organs as detectors and transducers. It is suggested that the complex chain of events between transducing a stimulus and initiating a nerve impulse is similar in receptor and central neurons and that information about either one is relevant to the other. The examples dealt with are electroreceptors in electric fish, mechanoreceptor hairs in arthropods, infrared receptors in pit vipers and specific chemoreceptors in flies and moths. J.Iball

612.014.48

10449. MEASUREMENTS WITH A WHOLE BODY COUNTER.
K.G.McNeill and R.M.Green.
Canad. J. Phys., Vol. 37, No. 6, 683-9 (June, 1959).

An account is given of work on the measurement of the gamma radioactivity of humans. A steel room has been constructed, in which this gamma activity may be measured to a statistical accuracy of a few per cent in 30 minutes using a 5 in. NaI crystal as detector. The average potassium content of thirty 19-year-old males living in Ontario has been found to be 0.21_8% of body weight,and the average Cs/K ratio 51 μμc/g K.

612.843

10450. EFFECT OF THE TEST STIMULUS ON THE MEASUREMENT OF DARK ADAPTATION. E.J.Sweeney.
J. Opt. Soc. Amer., Vol. 49, No. 7, 667-8 (July, 1959).

Questions have been raised in dark adaptation experiments about the light adapting effect of the test flashes used to measure the course of dark adaptation. An experiment was undertaken to determine the allowable upper limit of the test stimulus. A series of one-fifth second flashes of a given intensity was presented to the observer after he had become dark adapted, and his recovery of the dark adapted state was determined. The net effects of the flashes were plotted for various values of flash intensities in a range several log units above the threshold.

612.843

10451. NYSTAGMUS INDUCED BY VISUAL FEEDBACK.
J.M.Hedlun and C.T.White.
J. Opt. Soc. Amer., Vol. 49, No. 7, 729-30 (July, 1959).

Experiment showed that when the retinal image is stabilized or partly-stabilized the eye undergoes nystagmoid movements. The type of movement is related to the degree of stability (amount of visual feedback) of the image. E.A.Mussett

612.843 : 535.317.1

10452. THE CONTRAST SENSITIVITY OF THE EYE AS A FACTOR IN THE EVALUATION OF OPTICAL IMAGES. K.J.Rosenbruch.
Optik, Vol. 16, No. 3, 135-45 (March, 1959). In German.

Periodic test objects of variable contrast were used to determine the smallest angular subtense of the spatial frequency at which the eye could distinguish a given contrast. Results are given for a range of illumination levels and compared with the contrast transfer function of the eye. W.T.Welford

612.843

10453. DEPTH-DISCRIMINATION THRESHOLDS AS A FUNCTION OF BINOCULAR DIFFERENCES OF RETINAL ILLUMINANCE AT SCOTOPIC AND PHOTOPIC LEVELS. A.Lit.
J. Opt. Soc. Amer., Vol. 49, No. 8, 746-52 (Aug., 1959).

The precision of depth discrimination was measured in a two-rod test apparatus involving real-depth cues. The effects of two variables were studied: (a) the level of equal retinal illuminance presented to the two eyes; and (b) the difference in the level of the retinal illuminance presented to the two eyes. It was found that depth discrimination in this test varies as a function of the level of equal retinal illuminance presented to the two eyes in much the same way that acuity or intensity discrimination vary with luminance. Stereoscopic threshold angles vary more than 19:1 over some five log units of variation in illuminance. Unequal retinal illuminance presented to the two eyes at any given illuminance level has a comparatively small deleterious effect upon the precision of depth discrimination. This effect progressively increases as the inequality of retinal illuminance is increased. These results have significance for photochemical theories of vision and for the classical theory of binocular space discrimination.

612.843

10454. NEURAL LIMITATIONS OF VISUAL EXCITABILITY.
I. THE TIME COURSE OF MONOCULAR LIGHT ADAPTATION.
W.S.Battersby and I.H.Wagman.
J. Opt. Soc. Amer., Vol. 49, No. 8, 752-9 (Aug., 1959).

Monocular visual excitability was studied psychophysically by determining the threshold intensity for a small (40 min) brief (5 msec) "test" flash centred within a larger (3°) "conditioning" flash, both presented at 7° of arc in the temporal half-field. Interval between flashes was varied from −200 (test flash preceding onset of conditioning) to +1500 msec (test flash following), nine combinations of conditioning flash intensity and duration being used as parameters For all combinations, threshold rose between −200 and −100 msec (before the start of the conditioning flash), reaching a maximum increment when the onsets of the two flashes were synchronized. Whe test was superimposed upon conditioning flash in time (positive intervals), threshold declined to approach an asymptote near the end of the latter flash. Following termination of the conditioning flash, threshold returned to resting level. The maximum rise in threshold as well as the time taken to achieve an asymptote, varied with both intensity and duration of the conditioning flash. When a rough estimate of the photochemical contribution to these threshold changes was subtracted from the raw data, residual threshold increments were obtained and attributed to neural processes. On the basis of time course, it is suggested that these neural processes involve central (geniculocalcarine) as well as peripheral (neuro-retinal) factors.

612.843

10455. EFFECTS OF SHARP EDGES IN A FLICKERING FIELD.
D.H.Kelly.
J. Opt. Soc. Amer., Vol. 49, No. 7, 730-2 (June, 1959).

Photopic frequency response curves (modulation ratio threshold v. frequency) are shown to depend considerably on the nature of the visual field. The significance of this to the tremor theory of pattern vision is discussed. E.A.Mussett

612.843

10456. FLICKER CONTOURS FOR INTERMITTENT PHOTIC STIMULI OF ALTERNATING DURATION.
D.M.Forsyth and C.R.Brown.
J. Opt. Soc. Amer., Vol. 49, No. 8, 760-3 (Aug., 1959).

Flicker studies generally employ a train of light pulses consisting of a single period of stimulation repeated serially. In a recent study, fusion points were measured using trains of light pulses in which alternate periods were of different duration. Fusion points obtained with this type of stimulation are best described by a

sion contour which identifies those combinations of two periods
ich, when alternated serially, result in a transition point between
cker and fusion. In the present study, data were obtained on three
cker contours each of which identifies those combinations of two
riods which, when alternated serially, have the same apparent rate
flicker. A matching technique was used to measure the subjective
te of trains of light pulses. Data points were obtained from ob-
rvers who matched the apparent rate of a variable stimulus (com-
sed of two periods of alternating duration) to the apparent rate of
standard stimulus (composed of a single period repeated serially).
ındard rates of 33.3, 28.6, and 25 c/s were used. The fusion con-
ır for each of the two observers in the experiment is also shown.
ıe fusion and flicker contours are not dichotomous: as the frequency
the standard stimulus is increased, the flicker contours tend to
semble more closely the shape of the fusion contour. The contours
ustrate the limiting values within which various combinations of two
ernating periods may have the same apparent rate: (1) The sum of
durations of the two alternating periods must be greater than the
ration of the period of the standard stimulus; (2) The sum of the
rations of the two periods must be less than twice the duration of
period of the standard stimulus.

612.843

457. RAPID CHROMATIC ADAPTATION OF NORMAL AND
CHROMATIC OBSERVERS.
M.Boynton, G.Kandel and J.W. Onley.
Opt. Soc. Amer., Vol. 49, No. 7, 654-66 (July, 1959).

A large number of spectral sensitivity curves has been obtained
r three observers: a normal, a deuteranope, and a protanope, by
eans of a rapid chromatic adaptation technique. Sensitivity curves
r several adapting luminances and colours have been obtained. It
s proved possible to fit these data by summing three hypothetical
derlying sensitivity functions which are applicable to all three ob-
rvers. The analysis of the theoretical fits appears to be in support
the concept of protanopia as a lack of "red cones" and of deuter-
opia as a fusion of the inputs from "red" and "green cones".
ıere is evidence that chromatic adaptation is not, however, as
lective as the hypothetical underlying sensitivity functions require.

612.843

458. COLOR VISION AND THE NATURAL IMAGE. I-II.
H.Land.
oc. Nat. Acad. Sci. U.S.A., Vol. 45,No.1, 115-29 (Jan.); No. 4,
6-44 (April, 1959).

612.843

459. NATURE OF THE LIMIT OF THE COLOR ZONE IN
RIMETRY. P.A.Kelsey and I.Schwartz.
Opt. Soc. Amer., Vol. 49, No. 8, 764-9 (Aug., 1959).

Blue and yellow outer colour zones on the lower vertical
eridian were measured in a Goldmann spherical projection peri-
eter using three different techniques and four observers. The
nits of the colour zones are not smooth but show irregular peaks
d dips and do not have sharp cutoffs in sensitivity. The peaks and
os are reliable for any given observer, although they do not cor-
spond between observers. The method of constant stimuli, the
ethod of limits, and the clinical one-directional technique were
mpared. The method of constant stimuli is the most reliable
ethod and it gives the most information about the shape and size of
colour gradient.

612.843

460. NOTE ON THE INFORMATION CAPACITY OF A
LOURED PICTURE. H.Satō.
Phys. Soc. Japan, Vol. 13, No. 1, 108-11 (Jan., 1958).

The information capacity of a coloured picture is obtained
ing into account the restriction inherent to the human perception
colour. Calculations are made concerning a one-dimensional
ture, and the result is used as an upper bound for the capacity
a two-dimensional picture.

612.843

461. THE ROLE AND ASPECTS OF SATURATION IN CHROM-
IC SENSATIONS. H.Piéron.
ta electronica, Vol. 2, No. 1-2, 55-9 (1957-58). In French.

"Physical problems of colour television" Conference Paper
e Abstr. 1006 of 1958). Attention is drawn to some psycho-
sical aspects of saturation. R.A.Weale

612.846

10462. VISUAL EFFECTS OF VARYING THE EXTENT OF COMPENSATION FOR EYE MOVEMENTS. L.A.Riggs and S.Ü.Tulunay.
J. Opt. Soc. Amer., Vol. 49, No. 8, 741-5 (Aug., 1959).

The effects of small, involuntary eye movements were counteracted by an optical system that fixes a test image at a given point on the retina. This causes the test object to disappear. In the present experiment the relative amount of image motion was varied over a wide range, with special attention to the condition of nearly complete absence of image motion. The disappearance is greatest for low contrast images with minimal amounts of motion.

612.85

10463. GRAPHICAL PRESENTATION OF DATA IN THE FRAMEWORK OF THE THEORY OF SIGNAL DETECTABILITY.
W.P.Tanner, Jr.
J. Acoust. Soc. Amer., Vol. 31, No. 2, 243-4 (Feb., 1959).

Improved interpretation is claimed when plotting psychophysical data relating measures of performance to signal energy.
H.D.Parbrook

612.85

10464. TWO TYPES OF ROC CURVES AND DEFINITIONS OF PARAMETERS. F.R.Clarke, T.G.Birdsall and W.P.Tanner, Jr.
J. Acoust. Soc. Amer., Vol. 31, No. 5, 629-30 (May, 1959).

An attempt to clarify the existing confusion between two types of curve. A common notation is suggested. For definitions of some symbols see Abstr. 4179 of 1959.

612.85

10465. OPERATING CHARACTERISTICS DETERMINED BY BINARY DECISIONS AND BY RATINGS.
J.P.Egan, A.I.Schulman and G.Z.Greenberg.
J. Acoust. Soc. Amer., Vol. 31, No. 6, 768-73 (June, 1959).

With the theory of signal detectability as a framework, two psychophysical experiments were conducted in which each observation interval was well defined for the listener. Each interval contained noise, and it either did or did not ($p = 0.5$) contain a signal (1000 c/s, 0.5 sec in duration). In separate sessions of the first experiment, either the listener gave a yes—no decision or he responded with a rating (1-4) after each observation interval. Operating characteristics were obtained with E/N_0 equal to 15.8. It is clear from the data that the trained listener can perform as well when he adopts the multiple criteria necessary for the rating method as when he adopts the single criterion required by the binary-decision procedure. In the second experiment, only the rating method was used to determine the relation between d' and E/N_0. The resulting function, for $d' \leq 3.0$, approximates a straight line which passes through the origin and which has nearly the same slope as that obtained in other laboratories.

612.85

10466. SOME MEASUREMENTS ON THE EFFECTS OF INTERCHANNEL INTENSITY AND TIME DIFFERENCES IN TWO CHANNEL SOUND SYSTEMS. D.M.Leakey.
J. Acoust. Soc. Amer., Vol. 31, No. 7, 977-86 (July, 1959).

The results of some practical measurements on the effects of interchannel intensity and time differences in two channel (stereophonic) sound systems are presented. The effects of alterations in the listener position are also covered. The test signals used ranged from single component tones to wide and narrow band noise and included running speech. A theory based on the assumption that the brain is sensitive to interaural time difference and its variation with head movement is developed and is shown to be in reasonable agreement with the practical findings.

612.85

10467. SEMANTIC REACTIONS TO SYSTEMATICALLY VARIED SOUNDS. L.N.Solomon.
J. Acoust. Soc. Amer., Vol. 31, No. 7, 986-90 (July, 1959).

Noise bands simulating passive sonar sounds were varied in terms of spectrum (band passes from 150-600 c/s, or 600-2400 c/s, or 2400-9600 c/s); in terms of amplitude modulation (simulated screw beats) at beat rates of 0, 3, 5, or 11 per sec; and in terms of presence or absence of accent within a group of 4 beats. Every combination of these parameters (21 in all, not 24, since at zero beat rate there can be no accent) was rated by 20 subjects in terms of their aurally perceived characteristics on 15 scales representing seven different dimensions. Analysis was made of the manner in which the 21 sounds clustered within the space defined by the seven psychological dimensions. Two major clusters of sounds were observed, differentiated primarily on the basis of band pass condition (high frequency v. low frequency). Exceptions to this general rule were analyzed to reveal the interactions between band pass condition, beat rate and accent.

612.85

10468. PSYCHOPHYSICAL ESTIMATE OF THE VELOCITY OF THE TRAVELING WAVE.

E.D.Schubert and B.S.Elpern.

J. Acoust. Soc. Amer., Vol. 31, No. 7, 990-4 (July, 1959).

An extension of a method originally employed by Békésy (see Abstr. 4603 of 1933) was used to estimate the velocity of the travelling wave along the cochlear partition. The method consists of masking a different length of the basilar membrane at each of the two ears so that the wave produced by a simultaneous click at the ears emerges from the shorter masked portion of one ear sooner than from the other. As a result the click lateralizes toward the side where the wave emerges sooner. The time interval by which the click to the "earlier" side must be delayed to centre the subjective click is an estimate of the original difference in time of emerging from the masking and hence of the time taken to travel the portion of the membrane represented by the difference in cutoff frequency of the two masking noises. Measurements were taken for 14 overlapping half-octave segments of the basilar membrane on 7 subjects. Measurement was not possible below 1000 c/s with the instrumentation used. The velocity estimates range from 55 m/sec near the stapes to approximately 30 m/sec at a point some 20 mm away.

612.85

10469. AUDITORY ADAPTATION IN NOISE.

H.N.Wright.

J. Acoust. Soc. Amer., Vol. 31, No. 7, 1004-12 (July, 1959).

The initial rate, extent, and recovery from auditory adaptation were measured in both the presence and absence of noise in ten normal ears by the method of fixed intensity at 250, 1000, and 4000 c/s. It was found that the inital rate and extent of adaptation to a tone in noise were greater than to the tone alone at 4000 c/s, but not at either 250 or 1000 c/s. Recovery from adaptation to tones in both noise and quiet was found to be equivalent, but never complete, at each frequency. When the noise was sustained in one ear and a tone introduced over the noise at 1 min intervals, there was a systematic decline in response at 250 and 1000 c/s, but not at 4000 c/s. When the noise was not sustained, but followed the same periodic intervals as the tone, there was a decline in response at 4000 c/s, but not at either 250 or 1000 c/s.

612.85 : 534.781

10470. EFFECT OF SAMPLE DURATION ON THE ARTICULATION OF SOUNDS IN NORMAL AND CLIPPED SPEECH.

R.Ahmend and R Fatehchand

J. Acoust. Soc. Amer., Vol. 31, No. 7, 1022-9 (July, 1959).

Segments of vowels and consonants from nonsense syllables, accurately determined in position and width, are used for articulation measurements. The listening tests are performed on differentiated speech, and on differentiated speech subjected to severe clipping. Whether or not vowels are clipped, their segment lengths can be considerably reduced with little effect on articulation. This does not hold for consonants, with the exception of unclipped semivowels. The high articulation of interrupted speech is discussed, and some results are given.

612.85

10471. ON INDICES OF SIGNAL AND RESPONSE DISCRIMINABILITY.

I.Pollack.

J. Acoust. Soc. Amer., Vol. 31, No. 7, 1031 (July, 1959).

Two indices of a listener's performance in a communication system are distinguished. One reflects the discriminability among the items of the message source — the index of signal discriminability. One reflects the discriminability by a listener among his own responses — the index of response discriminability.

612.858

10472. RELATION BETWEEN HEARING THRESHOLD AND DURATION FOR TONE PULSES.

R.Plomp and M.A.Bouman.

J. Acoust. Soc. Amer., Vol. 31, No. 6, 749-58 (June, 1959).

This paper deals with some measurements concerning the threshold v. duration for tone pulses. A new hypothesis is introduced: Switching on a tone pulse of intensity I results in an effect s somewhere in the hearing pathway, that approaches its final value asymptotically according to an exponential function; this final value is proportional to I; perception occurs when s exceeds a critical value s_0. The experiments show that this hypothesis gives a better description than the hypotheses thus far used. The time constant varies from ~ 375 msec at 250 c/s to ~ 150 msec at 8000 c/s For short pulse durations the data deviate from the hypothesis. This deviation can be explained by the assumption that energy integratio around each frequency is restricted to a fixed bandwidth. A formul is derived which gives a correction to the mentioned relationship f short durations. In this way the bandwidth at the different frequencies could be determined. The general course of this bandwidt as a function of frequency agrees with the "Kopplungsbreite" after Gässler.

612.85

10473. TEMPORARY THRESHOLD SHIFT PRODUCED BY INTERMITTENT EXPOSURE TO NOISE.

W.D.Ward, A.Glorig and D.L.Sklar.

J. Acoust. Soc. Amer., Vol. 31, No. 6, 791-4 (June, 1959).

The TTS at 4 kc/s was measured 2 and 17 min after successi 12 min exposures to broad-band noise at 106 dB SPL separated by 18 min of silence. The results indicate that the TTS existing at the beginning of a particular exposure can be treated as additional time of exposure. Thus, if the residual TTS has a value that would be produced by R min of exposure, then the total TTS at the end of an M min exposure will be given by solving the equation for growt of TTS with exposure time set equal to M + R.

612.85

10474. AUDITORY PERCEPTION OF TEMPORAL ORDER.

I.J.Hirsh.

J. Acoust. Soc. Amer., Vol. 31, No. 6, 759-67 (June, 1959).

Whereas temporal intervals as short as a few msec are sufficient to separate two brief sounds so that a listener will repor that there are two (instead of only one) sounds, a longer separatio time of between 15 and 20 msec is required for the listener to report correctly which of the two sounds preceded the other. This minimum temporal interval appears to be independent of the kinds of sounds used: whether short or long, of high or low frequency, of narrow or wide bandwidth. There is some suggestion that rise-time and duration may change this minimum interval, but these somewhat secondary relations are not investigated in detail here. The length of the required temporal interval suggests that the judgment of order requires other mechanisms than those associate with the peripheral auditory system.

612.8

10475. BINAURAL INTERACTION OF HIGH-FREQUENCY COMPLEX STIMULI.

E.E.David, Jr, N.Guttman and W.A.van Bergeijk

J. Acoust. Soc. Amer., Vol. 31, No. 6, 774-82 (June, 1959).

An experiment is described in which time and intensity differences of 2 kc/s high-pass clicks were mutually offset to produce sound images centred in the head. Binaurally correlated and uncorrelated clicks were used, and the trade was tested at 10-70 d SL. The results show that generally the two types of clicks behav similarly, and that up to 60 dB SL, at least, as over-all intensity increases, the time difference compensating a given intensity diffe ence (in dB) decreases. A function is derived describing what is interpreted as a physiological intensity-to-time conversion. The place of such a conversion in lateralization is discussed.

612.8

10476. TONOTOPIC ORGANIZATION OF THE CAT AUDITORY CORTEX FOR SOME COMPLEX STIMULI.

N.Y-S.Kiang and M.H.Goldstein, Jr.

J. Acoust. Soc. Amer., Vol. 31, No. 6, 786-90 (June, 1959).

There is psychophysical evidence that both spectrum and periodicity of acoustic signals may be cues for pitch judgments. the levels of the auditory nerve, these stimulus characteristics seem to be coded in terms of place and time pattern. Very little known of their representation at higher levels of the nervous syst Tonotopic organization of the auditory cortex has been demonstrat in anesthetized cats by the evoked strychnine potential technique. In these demonstrations only tonal stimuli were used. Similar physiological preparations were used but employed acoustic stim that permitted independent manipulation of spectrum and periodic The results show that the previously reported tonotopic organizat is based only upon spectral characteristics of the stimulus.

612.858

0477. ADDITIVITY OF DIFFERENT TYPES OF MASKING.

R.C.Bilger.

J. Acoust. Soc. Amer., Vol. 31, No. 8, 1107-9 (Aug., 1959).

Two experiments were carried out to determine how masking for frequencies either above or below one band of noise combine with the critical-band type masking produced by a second band of noise. The results of both experiments indicate that at moderately high levels the combination of critical-band masking with another type of masking results in 6 dB increase in masking. The implications of this result are discussed.

612.858

10478. RESIDUAL MASKING AT LOW FREQUENCIES.

C.M.Harris.

J. Acoust. Soc. Amer., Vol. 31, No. 8, 1110-15 (Aug., 1959).

Short duration auditory fatigue, i.e., the temporary shift in the threshold of hearing following the cessation of a masking source, may be termed "residual masking". In this study, curves of residual masking v. frequency were obtained in a free-field in the low-frequency range, for 250 c/s masking tones at sound pressure levels of 90 and 110 dB, following the method of Munson and Gardner (see Abstr. 5633 of 1950). These masking patterns were obtained 150 and 200 msec after the cessation of the masking tone. In addition, residual masking at 250 c/s was measured as a function of the mel-band intensity level of a "white noise" masking source. Plots of loudness density v. frequency were computed from residual masking patterns, and the loudness of the pure-tone masking source was evaluated.

612.858

10479. RELATION BETWEEN LOUDNESS AND DURATION OF TONAL PULSES. I. RESPONSE OF NORMAL EARS TO PURE TONES LONGER THAN CLICK-PITCH THRESHOLD.

F.Miskolczy-Fodor.

J. Acoust. Soc. Amer., Vol. 31, No. 8, 1128-34 (Aug., 1959).

In normal ears, threshold intensity as a function of the duration of a tonal pulse is determined. Identical results are obtained by a reciprocal determination. The reciprocal determination is made by fixing the intensity level at specified points above reference threshold to measure the time threshold. The duration-intensity relationship reveals a marked dependency upon frequency; the differences observed are equivalent to the alteration of loudness function for the various test frequencies. A new measure of loudness increment degree, as well as conversion of decibel values into phon and sone values, indicates a close relationship between time threshold and loudness sensation. Therefore, the relationship between pulse duration and loudness level presents no artifacts reflecting frequency-dependent changes. The time threshold (T msec), as a fraction of pulse duration re the "adjusting time" of the auditory mechanism (150/T), seems to indicate the loudness of related levels above threshold in sones. General conclusions deriving from these relationships and some limitations of their applicability are discussed in detail; these are confirmed by a comparison between monaural and binaural time-threshold measurements.

614.898 : 539.17

10480. CONCRETE IN RADIATION-SHIELDING TECHNIQUE.

T.Jaeger.

Atomkernenergie, Vol. 2, No. 6, 217-22 (June, 1957). In German.

It is becoming increasingly necessary for concrete radiation shields to be design in detail. Therefore the following important design topics are discussed: the neutron cross-sections of the various elements in the concrete; the mean free paths and relaxation times; the interaction of photons with the shield material, i.e. photoelectric effect, pair production and Compton effect.

D.H.Lord

614.898 : 539.17

10481. CONCRETE IN RADIATION-SHIELDING TECHNIQUE.

T.Jaeger.

Atomkernenergie, Vol. 2, No. 7, 255-62 (July, 1957). In German.

Experiments on the absorption of narrow and broad beams of radiation in ordinary and heavy concrete are described. From the experimental results, the mass absorption coefficient is evaluated as a function of γ-ray energy and the increase of secondary X-rays as a function of beam width. The capture of neutrons, their elastic and inelastic scattering by the various elements in concrete, are reviewed. Various simple shield geometries are discussed.

D.H.Lord

614.898 : 539.17

10482. CONCRETE IN RADIATION-SHIELDING TECHNIQUE.

T.Jaeger.

Atomkernenergie, Vol. 2, No. 8-9, 338-44 (Aug.-Sept., 1957). In German.

Various methods for calculating the total attenuation of photo-radiation and the total effect of scattered radiation in a concrete shield are discussed. The neutron attenuation is calculated by the single- and two-group diffusion theory. As an example the calculated and experimental results for the shielding of the Windscale reactors are shown.

D.H.Lord

614.898 : 539.17

10483. CONCRETE IN RADIATION-SHIELDING TECHNIQUE.

T.Jaeger.

Atomkernenergie, Vol. 3, No. 2, 69-72 (Feb., 1958). In German.

The temperature variation of stopping power and the alteration of the material by radiation is considered.

J.M.Hough

614.898 : 539.17

10484. CONCRETE IN RADIATION-SHIELDING TECHNIQUE.

T.Jaeger.

Atomkernenergie, Vol. 3, No. 3, 101-8 (March, 1958). In German.

The various physical properties of concrete that are important in shielding, such as high density, high water content, composition, etc., are surveyed for various cements and additives. The composition and cost of the available additives are reviewed. Finally, concreting techniques, e.g., "puddling" and the Intrusion-Prepakt method, are discussed.

D.H.Lord

TECHNIQUE . MATERIALS

620.11

10485. REPLICA METHOD FOR EXAMINING SURFACE PROFILES. A.P.Young and B.H.Clegg.
Rev. sci. Instrum., Vol. 30, No. 6, 444-6 (June, 1959).

A nondestructive method for the light microscope examination of surface profiles by means of replicas has been developed. The method has been applied to the examination of the surfaces of gear teeth. Possible extension of the method to electron microscope examination of the profiles of nearly smooth surfaces is described.

66.07 : 533.5

10486. USE OF ULTRAHIGH VACUUM VALVES FOR GAS HANDLING. J.H.Carmichael and E.A.Trendelenburg.
Rev. sci. Instrum., Vol. 30, No. 6, (June, 1957).

669.05

10487. IMPROVEMENT IN FLOATING ZONE TECHNIQUE. W.G.Pfann, K.E.Benson and D.W.Hagelbarger.
J. appl. Phys., Vol. 30, No. 3, 454-5 (March, 1959).

Describes a way round the size limitation on rod forms in the floating zone process. The method is to use forms of cross-section small in thickness in order to permit melting through without exceeding the maximum height permitted by considerations of the density and surface tension of the liquid zone. Suitable cross-sections are available in plates and pipes. In plates the zones may extend across the plate or may be disk shaped. Preliminary experiments have been made to establish the stability limits of different zone forms of this nature in silicon, iron, tin, gold, lead and bismuth. W.Bardsley

669.053 : 539.18

THEORY OF SEPARATION OF ISOTOPES AND ALLOY COMPONENTS DURING PASSAGE OF ELECTRIC CURRENT THROUGH THE MELT. See Abstr. 10162

PHOTOGRAPHY

771.376

10488. MEASUREMENT OF THE EXPOSURE GUIDE NUMBER IN FLASH PHOTOGRAPHY. W.Lang and G.Kocher.
Tech. wiss. Abhandl. Osram-Gesell., Vol. 7, 337-44 (1958).
In German.

The exposure guide number for a given light source is defined as the product of the f-number and the distance between the light source and the object photographed. It can be calculated from the light output of the source and the minimum permissible exposure. The authors propose an alternative, empirical, method of determining it, the film used being exposed to the light source through a neutral wedge. They tabulate the numbers found in this way for four different types of film and six lamps, three photoflash and three electronic flash. J.W.T.Walsh

771.5

10489. RELATION BETWEEN GRAININESS AND GRANULARITY FOR BLACK-AND-WHITE SAMPLES WITH NONUNIFORM GRANULARITY SPECTRA. K.F.Stultz and H.J.Zweig.
J. Opt. Soc. Amer., Vol. 49, No. 7, 693-702 (July, 1959).

In order to determine the relation between the visual impression of graininess and the objectively determined granularity of a wide range of granularity types, a series of samples was prepared containing uniformly exposed black-and-white materials and prints (transparencies) containing varying degrees of mottle. These samples were judged by the method of paired comparisons at different magnifications and scanned to obtain the standard deviation $\sigma(D)$ for a wide range of scanning apertures. The psychophysical relationship between the two functions: (1) graininess versus magnification and (2) granularity $\sigma(D)$ versus the square root of the scanning area, depends on the character of the scanning operation performed by the eye. An estimate of the size of the effective scanning spot of the eye can be obtained from these data.

771.531 : 621.385.832

10490. EMULSION SENSITIVITY FOR THE PHOTOGRAPHY OF CATHODE-RAY TUBES. R.W.Tyler and F.C.Eisen.
J. Soc. Motion Picture Televis. Engrs, Vol. 68, No. 4, 222-5 (April, 1959).

Factors which are significant in the photography of c.r.o. traces were studied with a photometer built especially for this purpose and by means of photographic tests. Photometric tests showed that the initial decay of the P-11 phosphor is a logarithmic function of time and that recurrent traces on the same area of the screen do not all produce the same intensity of phosphorescence. For such multiple tracing, the intensity of phosphorescence was found to increase progressively for the first several traces; and, in some cases, the intensity of phosphorescence was found to decrease after the initial increase. Photographic tests made on four films with an oscilloscope camera, used in conjunction with the oscilloscope photometer, and with two sensitometers showed that the relative sensitivities of the films for oscilloscope photography can be evaluated fairly reliably by a sensitometric test when the sensitometer light source is filtered to produce a spectral energy distribution equal to the spectral energy distribution of the phosphorescent scre and if the exposure time is 250 μsec or less.

771.531 : 535.37

SPECTRAL COMPOSITION AND INTENSITY OF LUMINESCEN RADIATION OF A PHOTOGRAPHIC EMULSION. See Abstr. 9482

778.34 : 539.1.07

10491. PHOTOGRAPHIC OBSERVATION OF CHARGED PARTICLES IN A FILAMENTARY CHAMBER.
K.Lande, A.K.Mann, M.M.Schlachter, D.M.Skyrme and H.Uto.
Rev. sci. Instrum., Vol. 30, No. 6, 496-7 (June, 1959).

A close packed array of 1000 filaments of plastic scintillator, each 0.5 mm diameter and 4 cm long, was used with three image intensifiers to photograph cosmic ray particles dissipating about 2 MeV in the chamber. E.J.Burg

LIST OF JOURNALS

The following list supplements the List of Journals published with the Index to Volume 61 (1958). Reprints of the List of Journals can obtained from The Institution of Electrical Engineers, Savoy Place, London, W.C.2, price 2s.0d. post free.

The addresses given are believed to be correct at the date of publication, but no responsibility can be accepted for errors.

Res. Nat. Bur. Stand.	Journal of Research of the National Bureau of Standards. From July, 1959 this journal will be published in four separate sections. Section A: Physics and Chemistry — six issues per year. Section B: Mathematics and Mathematical Physics — quarterly. Section C: Engineering and Instrumentation — quarterly. Section D: Radio propagation — six issues per year.

NEW JOURNALS

tics and Spectrosc.	Optics and Spectroscopy [A translation of the journal Optika i Spektroskopiya of the Academy of Sciences of the USSR]. The Optical Society of America. Subscription address: American Institute of Physics, 335 East 45th Street, New York 17, N.Y. Vol. 6, No. 1 dated January, 1959.
viet Physics—Uspekhi (New York)	Soviet Physics—Uspekhi [A translation of Uspekhi Fizichesikh Nauk (Advances in the Physical Sciences) of the Academy of Sciences of the USSR]. American Institute of Physics, 335 East 45th Street, New York 17, N.Y. Vol. 1(66), No. 1 dated Sept.-Oct., 1958.

ERRATA

Abstr. 4346 (1953) line 5 : for "Be^{10}" read "B^{10}".
Abstr. 2174 (1959) line 3 : for "(July, 1958)" read "(July, 1956)".
Abstr. 3064 (1959) line 3 : for "E.P.Mustel'." read "E.R.Mustel'.".
Abstr. 5318 (1959) line 3 : for "H.L.Voigt" read "H.H.Voigt".
Abstr. 8406 (1959) line 3 : for "U.C.Allkofer" read "O.C.Allkofer".

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Zweig,H.J., 10489
Zwolenik,J.J., 9564
Zÿryanov,P.S., 9210, 9256,1024

Waveguide admittance

determined

in 20 seconds

with the

AEI **Automatic Admittance Plotter**

- For laboratory or production testing
- Available for 6%, 8% or 12% of X-band
- Accurate, easily-read display on a 'Smith' chart
- Easy to operate

Associated Electrical Industries supply a range of first-class test equipment for X-band and S-band, for rectangular waveguides and concentric lines.

For further information and technical data please write for publication G11028.

ASSOCIATED ELECTRICAL INDUSTRIES LIMITED

ELECTRONIC APPARATUS DIVISION BLACKBIRD ROAD, LEICESTER, ENGLAND

A5381

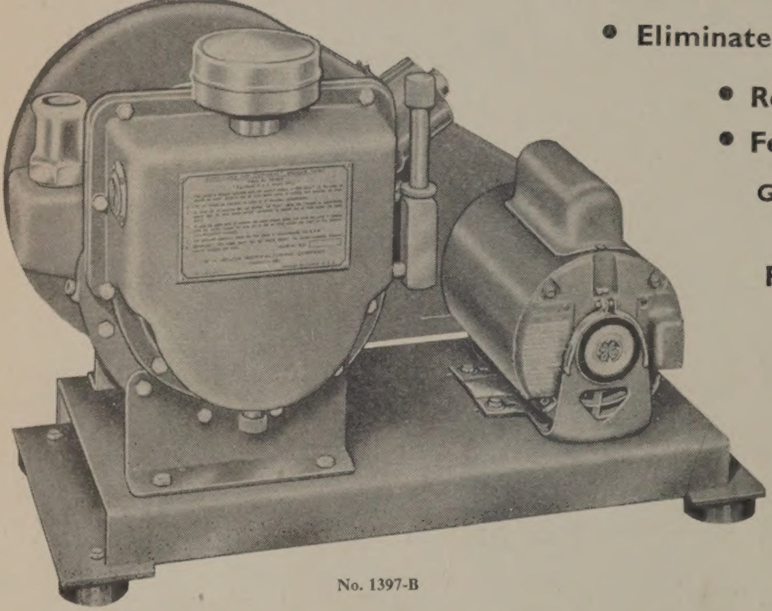
Large Capacity—High Vacuum

Welch TWO-STAGE DUO-SEAL® VACUUM PUMP

with VENTED-EXHAUST

PATENT No. 2,885,143

Removes Vapors Speedily and Effectively



No. 1397-B

- **Eliminates oil filters and separators**
- **Reduces pumpdown time**
- **Fewer oil changes required**

GUARANTEED VACUUM
0.0001 mm Hg. or 0.1 Micron

FREE AIR CAPACITY
375 Litres Per Minute

Ideal for backing-up Diffusion Pumps

Illustration Shows 1397-B Duo-Seal(R) Pump Equipped With Vented Exhaust

The Welch vented exhaust pump has provision for adjusting the amount of air introduced to meet various conditions of temperature and vapor concentration. The design is such that the air admitted through the exhaust vent cannot return to the system, so ultimate vacuum attainable approaches that of the same pump with the exhaust vent closed.

1397B. DUO-SEAL VACUUM PUMP, Motor Driven. For 115 Volts, 60 Cycles, A.C.	Each $645.00
1397C. DUO-SEAL VACUUM PUMP, Motor Driven. For 230 Volts, 60 Cycles, A.C.	Each $645.00
1397D. DUO-SEAL VACUUM PUMP, Motor Driven. For 115 Volts, D.C.	Each $749.00

A belt guard is included with the mounted pumps.

1397. DUO-SEAL VACUUM PUMP, Unmounted. With pulley, but without motor, belt or base.	Each $525.25

Thus the vented exhaust enables these Duo-Seal pumps to remove both permanent and condensable gases from a system without contamination of the oil. This means in practice that these pumps will be able to reach lower total pressures in shorter periods of time, and good vacuum performance will be possible for long periods without the bothersome trapping and excessive number of oil changes formerly necessary.

Pump Revolutions - 300 RPM
Motor - ¾ HP - 1725 RPM
Tubing Required - 1⅛-inch i.d.
Over-all Dimensions of Mounted Pump
25¼ × 14½ × 18¾ inches high
Belt-tightening Provision
Extra Supply of Duo-Seal Oil

W. M. WELCH SCIENTIFIC COMPANY
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Established 1880
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Manufacturers of Scientific Instruments and Laboratory Apparatus.

UNWIN BROTHERS LIMITED, WOKING AND LONDON